Wake Forest Board of Commissioners
Meeting Agenda
December 19, 2023 at 6:00 PM
All items listed are for discussion and possible action.

Notice

In accordance with the requirements of Title II of the Americans with Disabilities Act of 1990 (ADA), the Town of Wake Forest will not discriminate against qualified individuals with disabilities on the basis of disability in its services, programs, or activities. For individuals with impaired hearing, special equipment is available for use during meetings in the Town Hall board chambers. Anyone who requires an auxiliary aid or service for effective communication, or a modification of policies or procedures to participate in a program, service, or activity of Town of Wake Forest should contact ADA Coordinator Mickey Rochelle at 919-435-9455 or Town Clerk Terry Savary at 919-435-9432 as soon as possible, but no less than 48 hours before the scheduled event.

Cable & Online Broadcast of Board of Commissioners Meetings

All Board of Commissioners (BOC) meetings are broadcast live on WFTV 10 beginning at 6 p.m. Meetings are also streamed online on the Public Meetings Portal on the Town of Wake Forest website. Archived meeting videos are also provided and available for one year after the original air date.

Meeting Agendas

The BOC meeting agenda is available to be viewed and downloaded by noon on the Friday prior to the third Tuesday of each month. Citizens may request copies of the agenda or submit questions concerning agenda items by calling the Town Clerk's office at 919-435-9432. Citizens may also receive a copy of each month's agenda via email by enrolling in the free E-Notifier subscription service.

Public Hearings

When an agenda item is denoted as a Public Hearing, persons attending shall be permitted to address the BOC regarding the item under consideration.Anyone wishing to address the BOC concerning a public hearing item should complete and submit the BOC Public Comment Form on the Town website. Proponents and opponents shall each be given three minutes of time to speak and may choose to allow one speaker to utilize the time. In the event either proponent(s) or opponent(s) have not designated a speaker to represent the view, each speaker will be allowed three minutes each to express his/her comments, ideas, concerns, expressions, and desires. A designated speaker for a group will be allowed 10 minutes to speak. Only comments on a Public Hearing will be allowed during this time.

Public Comment

During the Public Comment period, anyone wishing to address the BOC concerning an issue or topic that is not a public hearing item or an agenda item should complete and submit the BOC Public Comment Form on the Town website. Then, during the Public Comment portion of the meeting, Mayor Jones will recognize you and invite you to the podium at which time you will have three minutes to speak. Thank you for your cooperation.

Call to Order

Pledge of Allegiance

1.Approval of Agenda

2.Approval of Minutes

2.A. November 9, 2023 Work Session
November 21, 2023 Regular Meeting
DraftBOCWSMinutesNov202309.pdf
DraftBOCMinutesNov202321.pdf

3.Presentations

4.Public hearings / Public Comment

4.A. Public Comment: If anyone would like to address the Board of Commissioners on an item other than a public hearing item during the time of public comment, please sign up with the Town Clerk prior to the meeting. Each speaker is asked to limit comments to 3 minutes. Please provide the clerk with copies of any handouts you have for the Board. Although the Board is interested in hearing your concerns, speakers should not expect Board action or deliberation on subject matter brought up during the Public Comment segment. Topics requiring further investigation will be referred to the appropriate Town Staff and may be scheduled for a future agenda. Thank you for your consideration of the Board of Commissioners, staff and other speakers.

5.Consent Agenda

(A Consent Agenda is a group of items passed with a single motion and vote. These matters are of a generally routine nature. No debate is allowable on any item included on the Consent Agenda. If a Commissioner or any citizen of Wake Forest or its ETJ wants separate consideration of any item, it may be removed from the Consent Agenda by request.)

5.A. Approval of a resolution to schedule the public hearing and certify the sufficiency for a petition requesting annexation submitted by Marion Jordan C/O Edward and Louise Smith for property associated with the rezoning request RZ-23-07, located at 200 Stephen Taylor Road, being Franklin County PINs 1842-82-6404 (parent PIN) and

1842-82-7362 (secondary PIN) being approximately 1.008 acres
121923 BOC Agenda Summary AN-23-04.pdf
Attachment A Legal Description AN-23-04.pdf
Attachment B Annexation Map AN-23-04.pdf
Attachment C Contiguous Annexation Petition AN-23-04.pdf
Attachment D Agent Authorization Form AN-23-04.pdf
CERTIFICATE OF SUFFICIENCY .docx
DRAFT PUBLIC HEARING RESOLUTION.docx

5.B. Approval of the 2024 Board of Commissioners Meeting Schedule
Resolution2023-75,
2024TOWFBoardOfCommissionersMeetingSchedule_Dec202319.pdf

5.C. Approval of Budget Ordinance Amendment # 1 - FY 2023 - 2024
Budget Ordinance Amendment_summary.pdf
Budget Ordinance Amendment # 1 FY 2023-2024.pdf

5.D. Approval of the Town of Wake Forest Affordable Housing Land Disposition Program Policy
2023-316 Agenda Item Summary
Exhibit A: Wake Forest Land Disposition Program Report
Attachment 1: Appendix 1 - Town of Apex Affordable Housing Incentive Zoning Policy
Attachment 2: Appendix 2 - Wake County Land Disposition Policy
Attachment 3: Appendix 3 - Town of Wake Forest Land Disposition Request for Proposal Template
2023-316 Resolution.docx

5.E. Approval of resolution updating the Internal Control Policy
Internal Control Policy update _summary.pdf
Internal Control Policy - TOWF_ update December 2023.pdf
resolution 2023 - Internal Control Policy update.docx

6.Legislative Items

6.A. Second Vote to Consider the Stormwater Utility Fee
Agenda Summary_121923.pdf
Attachment A_Ordinance.docx
Exhibit 1_Chapter 14_Article IV_V.docx

7.Planning Items

8.Administration and Financial Items

8.A. Consideration of a Resolution to approve the Transportation Impact Fee Study scope of work and fee and allow the Town Manager to enter into a contract with Benesch.
Agenda Item Summary_Transporation Impact Fee Update_ContractApproval.docx
Benesch - Submittal for Town of Wake Forest Transportation Impact Fee Study_revisedschedule.pdf
2023-xxx_Resolution.docx

8.B. Consideration of purchase of generation systems from Power Secure, Inc.
Generator Purchase _summary.pdf
Generator Replacement Cost Breakdown.pdf
Resolution 2023-xx Generator Replacement Purchase.docx
PRP 2023.12.07 Town of Wake Forest RFP#003-2023 Revised Signed RT.pdf

8.C. Consideration of Mutual Aid Agreement for the Town of Garner and Wake Forest
MUTUAL AID AGREEMENT FOR GARNER AND WAKE FOREST.docx

9.Public Services Items

10.Parks and Recreation Items

11.Public Safety Items

12.Other Business

12.A. Department Monthly Report
November 2023 Monthly Report Draft.pdf

12.B. Wake County Tax Release
WF-TXREP-DEC-2023-BOC-MTG.pdf

12.C. Commissioner Reports

12.D. Resolutions of Appreciation for Outgoing Commissioners
Resolution2023-76_AppreciationOfServicesForChadSary_Dec202319.pdf
Resolution2023-77_AppreciationOfServicesForJamesDyer_Dec202319.pdf

12.E. Oaths of Office for Commissioners-elect
Summary_Oaths of Office for Candidates Elect_Dec202319.pdf
OathOfOffice_CommissionerWright_Dec202319.pdf
OathOfOffice_CommissionerCross_Dec202319.pdf
OathOfOffice_CommissionerClapsaddle_Dec202319.pdf

12.F. Election of Mayor Pro Tem (Item added to agenda 12/19/2023)

13. Adjournment

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-326-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
November 9, 2023 Work Session
November 21, 2023 Regular Meeting

Recommendation:

Item Summary:

ATTACHMENTS

- DraftBOCWSMinutesNov202309.pdf
- DraftBOCMinutesNov202321.pdf

Wake Forest Board of Commissioners
Work Session Meeting Minutes

The Wake Forest Board of Commissioners met on **Tuesday, November 9, 2023,** at **6:00 p.m.** in the Board Room at Wake Forest Town Hall, 301 S Brooks Street.

Mayor Jones called the meeting to order at 6:00 p.m.

Commissioners Present: Mayor Vivian A. Jones, Commissioner Jim Dyer, Commissioner Chad Sary, Commissioner Keith Shackleford, Commissioner Nick Sliwinski, and Commissioner Adam Wright.

Commissioners Absent: None.

Staff Members Present:

Town Manager Kip Padgett
Assistant Town Manager Candace Davis
Assistant Town Manager Allison Snyder
Town Attorney Hassan Kingsberry
Legal Services Intern Aaliyah Lecompte
Town Clerk Theresa Savary
Planning Director Courtney Tanner
Assistant Planning Director Jennifer Currin
Organizational Performance Director Lisa Hayes
Downtown Development Director Jennifer Herbert
Downtown Development Specialist Camryn Gutierrez
Public Facilities Specialist Stephen Carpenter
Senior Civil Engineer Chris Glass
Assistant Stormwater Engineer Nick Nolte
Finance Director Samantha Sanchez
Captain Brandon High

1. Presentations

Presentation of LEGISLATIVE CASE RZ-23-02, Stadium Drive Mixed Use, a rezoning filed by Williams Mullen to rezone 19.30 acres located at 0 Stadium Dr, being Wake County Tax PIN 1831957846 from Rural Holding District (RD) and Special Highway Overlay (SH1-O) to Neighborhood Mixed-Use Conditional District (NMX-CD) and Special Highway Overlay (SH1-O). Chairman of the Wake Forest Area Chamber of

Assistant Planning Director Jennifer Currin presented Case RZ-23-02, Stadium Drive Mixed Use. She reported that at the Board of Commissioners Meeting scheduled on November 21, 2023, the requested action was to act on the Plan Consistency Statement as well as act on the rezoning request. Ms. Currin shared a range of plans such as the aerial map, zoning map, land use plan, corridor commercial, and activity center.

Ms. Currin stated the Planning Board recommended approval at the October 10, 2023 Planning Board Meeting by a vote of 5-0. The Planning Board found it was consistent with the Comprehensive Plans and in the best public interest. The Planning Board made the following recommendations for the applicant to consider:

- Include more specificity to the public art commitment
- Provide a commitment to provide green infrastructure elements
- Better define how placemaking will be provided
- Provide a crosswalk across Stadium Drive
- Provide building renderings

Ms. Currin went on to share the existing conditions plan, master site plan, site data, TIA improvements, grading plans, landscaping plans, and zoning modifications.

Ms. Currin shared the proposed conditions as shown in the staff report (Attachment B). She highlighted the modifications made based on the recommendations made by the Planning Board. The developer has made an additional commitment of $50,000 towards public art in their conditions. The developer indicated that between retail buildings 1 and 2, they would construct sidewalks of stamped concrete or paver stones, decorative crosswalks, and decorative lighting. Additionally, the developers indicated they'd work with NCDOT and provide a crosswalk across Stadium Drive from their development to the shopping center. At this time, the applicant has not committed to any green infrastructure improvements or building renderings that are not required as part of this process.

Staff recommends approval of the proposed conditional rezoning and finds it to be consistent with the Comprehensive Plan and in the best public interest for the following reasons:

1. The proposed zoning district is consistent with the Corridor Commercial Future Land Uses in the Community Plan.
2. The proposed rezoning supports Community Plan policies related to Activity Centers by providing a higher density along key corridors and activity centers.

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3. The proposed rezoning support Community Plan policies related to Commercial Development by providing a multi-story mixed-use building commitment and creating a pedestrian-oriented shopping environment.
4. The proposed rezoning supports Community Plan policies related to Residential Character by creating a pedestrian-friendly environment.

Mayor Jones asked if the Board had any questions. No questions were heard.

1.2. Proclamation Recognizing Friday, November 24, 2023, as Plaid Friday and Saturday, November 25, 2023, as Small Business Saturday.

Mayor Jones read the proclamation into the record.

NATIONAL COMMUNITY PLANNING MONTH
PROCLAMATION

WHEREAS, change is constant and affects all cities, towns, suburbs, counties, boroughs, townships, rural areas, and other places; and
WHEREAS, community planning and planners can help manage this change in a way that provides better choices for how people work and live; and
WHEREAS, community planning provides an opportunity for all residents to be meaningfully involved in discussions regarding the future of their community; and
WHEREAS, the full benefits of planning requires public officials and citizens who understand, support, and demand excellence in planning and plan implementation; and
WHEREAS, the month of October is designated as National Community Planning Month throughout the United States of America and its territories, and
WHEREAS, the American Planning Association and its professional institute, the American Institute of Certified Planners, endorse National Community Planning Month as an opportunity to highlight the contributions sound planning and plan implementation make to the quality of our neighborhoods and environment; and
WHEREAS, the celebration of National Community Planning Month gives us the opportunity to publicly recognize the participation and dedication of the members of planning boards and other citizen planners who have contributed their time and expertise to the improvement of the Town of Wake Forest; and
WHEREAS, we recognize the many valuable contributions made by the professional community of the Town of Wake Forest and extend our heartfelt thanks for the continued commitment to public service by these professionals;

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BE IT RESOLVED THAT, the month of October 2023 is hereby designated as "Community Planning Month" in the Town of Wake Forest in conjunction with the celebration of National Community Planning Month.

Mayor Jones presented the proclamation to Downtown Development Specialist Camryn Gutierrez and small business owner Johanna Trotter.

1.3. Presentation of Stormwater Utility Advisory Group Recommendations

Assistant Stormwater Engineer Nick Nolte introduced Michael Almquist a member of the Stormwater Advisory Group who helped develop the recommendation.

Mr. Nolte also introduced Trey Shanks with Freese and Nichols who helped guide them through the process.

Mr. Nolte and Mr. Almquist spoke about the Town's stormwater needs, and the Stormwater Utility Advisory Group recommendations including service level, fee structure and rates, fee assessment mechanism, and the next steps.

Mayor Jones asked if it was $10 million per year for capital projects. Mr. Nolte stated it's $10 million over 10 years.

Commissioner Sary asked how the project is being prioritized. Mr. Nolte said they may go to the advisory group they currently have to help them steer and prioritize the projects. They may also reach out to a consultant to help prioritize criticality needs.

Commissioner Sliwinski asked if any opportunities or programs would be rolled out to help citizens who can't afford a tax increase. Mr. Nolte stated there currently is no program but it's something they'll explore. He said they do have intentions to provide services for people who can't afford that utility.

Mayor Jones asked if the Board had any more questions. No further questions were heard.

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1.4 Presentation of reimbursement agreement between the Town of Wake Forest and Taylor Morrison of Carolinas, Inc.

Senior Civil Engineer Chris Glass discussed the upcoming reimbursement agreement. Tayor Morrison of Carolinas, Inc. provided a cost estimate of $473,960.00, and staff reviewed and thought it was a very reasonable cost.

Mayor Jones asked if there were any questions. No questions were heard.

1.5 Presentation of Community Plan Amendment related to the Wake Forest/Raleigh Utility Merger Agreement (CPA-23-03)

Planning Director Courtney Tanner provided an overview of CPA-23-03: Comprehensive Plan Amendment.

Ms. Tanner stated that the Planning Board recommended denial with a vote of 4-1. The Planning Board also stated if the Board of Commissioners should decide to move forward with the amendment: Consider adding a land use option that is more rural than Conventional Residential to the Community Plan if the Community Plan is amended.

Ms. Tanner stated staff recommendation is approval of the proposed Comprehensive Plan Amendments for the following reasons:

- Provides guidance to the Town as to the appropriate zoning should a property owner request municipal water and/or sewer.
- Articulates how conservation design principles should be prioritized to help maintain water quality, protect valued habitat and ecosystems, and design within the context of environmental features and assets.
- Advises that any development of the area should incorporate pedestrian and bicycle trails and connections that enhance access to the reservoir.

Ms. Tanner answered questions regarding parks and open spaces.

Commissioner Sliwinski said, as to the Planning Board's recommendation, is there a classification that would be more rural and less dense than General Residential 3. Ms. Tanner replied it's important they don't mix up zoning districts and the land use map. Commissioner Sliwinski said it is his understanding this is to give guidance to staff on what the Town would like to see if someone wanted to be annexed in and build

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conventional residential. He said they want the conservation and all the watershed protection, correct. Ms. Tanner stated that is the goal.

Commissioner Sary said it gives them the means to have some type of say and what can potentially happen out there.

Mayor Jones asked if there were any further questions. No further questions were heard.

1.6 Wake Forest Downtown Plan: Houseal Lavigne (Consultant) Presentation

Assistant Planning Director Jennifer Currin introduced Nik Davis with Houseal Lavigne.

Mr. Davis reviewed the planning process, the visioning workshops recap, the existing conditions overview, the existing land use, and the development overview.

Ben King with Noell Consulting Group spoke about the market analysis and the Municipal Service District (MSD) analysis and evaluation.

Jared Draper provided an overview of the transportation and parking assessment.

Commissioner Sary asked if they've taken the parking deck project into consideration with their recommendations. Mr. Draper replied, currently they're not at recommendations but will consider it when they get there.

Tenecia Jones with LS3P discussed the building fabric and public realm assessment.

Mr. Davis discussed the next steps of the project. He shared there is still an opportunity for the public to participate in the survey. It will be available on the Town's website for at least until the end of November 2023.

Mayor Jones said it is interesting and exciting to see what they come up with. She appreciates all the work and said it'll be fun seeing it develop.

No further questions or comments were heard.

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2. Discussion of Monthly Financial Report

2.1. Monthly Financial Report

Received.

3. Review of Draft Agenda for Upcoming Regular Meeting

3.1. Review of Draft Agenda for Upcoming Regular Meeting

The draft agenda was reviewed.

Town Manager Padgett stated one item needs to be added to the consent agenda: Resolution to approve a transaction with JP Morgan for the Street Resurfacing Project.

4. Other Business

4.1. Consideration of LEGISLATIVE CASE RZ-21-08, Joyner Property, a rezoning filed by McAdams Company to rezone 124.68 acres located at 1180 and 1200 (portion) Club Villas Dr, being Wake County Tax PINs 1841091336 and 1831895139 (portion) from General Residential 3 Planned Unit Development* (GR3 PUD*); Falls Lake Watershed Protection Overlay (FL-WMA); and Special Highway Overlay (SH1-O) to General Residential 10 Conditional District (GR10-CD); Falls Lake Watershed Protection Overlay (FL-WMA); and Special Highway Overlay (SH1-O). (*While these parcels are labeled as GR3 (PUD), the parcels are not subject to any PUD regulations as the PUD regulations were removed when SU-99-02-01 was approved. Due to the zoning map label, staff will refer to the current zoning as GR3 PUD until such time the official zoning map is amended to remove the PUD text.)

Assistant Planning Director Jennifer Currin shared a little history about the Joyner Property. The Planning Board recommended disapproval by a vote of 4-1 at their September 12, 2023 meeting. Ms. Currin said the Planning Board made several requests for the applicant to consider if the Board of Commissioners were to consider approval. There was a public hearing held on October 17, 2023, and a motion for disapproval was made by the Board of Commissioners, which failed by a vote of 2-3. The Board made action to table the case until the November 9, 2023, Board of Commissioners Work Session.

Since the public hearing, the applicant has proposed the following:

- Condition #13 kept by applicant (reduction in SHOD buffer)
- Condition #14 kept by applicant (reduction in SHOD setback)
- Condition #17 revised to remove Clubhouse Villas HOA as recipient of Park #1 as requested by that HOA
- Condition #19 revised to be consistent with staff's recommended language for Phase II report
- Condition #20 removed (no-right turn sign request)
- Condition #22 removed (Club Villas Drive cross-section request)
- Condition #23 added that developer would incur cost of Community Plan Amendment

Staff's recommendation is still for denial since the rezoning and master plan are inconsistent with the Comprehensive Plan, and UDO waivers are requested.

Ms. Currin stated if the Board of Commissioners were to approve the rezoning request, staff recommends only accepting Conditions 1-12 and 15-23.

Commissioner Shackleford disclosed that his firm was consulted to clarify who the proper owner and who the grantee should be on the deed.

ACTION:
Mover: Commissioner Sliwinski moved to deny Case RZ-21-08, Joyner Property with the inconsistency statement.
Seconder: Commissioner Wright.
Vote: Motion carried 3-2 to deny.

Aye	**Nay**
Commissioner Sliwinski	Commissioner Sary
Commissioner Wright	Commissioner Dyer
Commissioner Shackleford	

Commissioner Sary appreciates all the effort that's been made in the correspondence and meetings over the existence of this project. He spoke about the likely outcomes of what could happen on the property.

4.2 CIP Project Tracker

Received.

4.3 Strategic Plan

Received.

4.4 Consultation with the Town Attorney, N.C.G.S. § 143.318.11(a)(3).”

ACTION:
Mover: Commissioner Sary made a motion to go into closed session at 7:46 p.m.
Second: Commissioner Wright.
Vote: Motion carried 5-0.

The Board returned from closed session at 8:31 p.m.

ACTION:
Mover: Commissioner Dyer made a motion to approve the acquisition of the permanent wall easement and temporary construction easement at 1500 Heritage Garden Street for the South Franklin Street Widening project.
Second: Commissioner Wright.
Vote: Motion carried 5-0.

ACTION:
Mover: Commissioner Wright made a motion to approve a resolution of the Board of Commissioners regarding the acquisition of the permanent wall easement and temporary construction easement at 1504 Heritage Garden Street for the South Franklin Street Widening project.
Second: Commissioner Sary.
Vote: Motion carried 5-0.

ACTION:
Mover: Commissioner Sary made a motion to approve the resolution of the Board of Commissioners regarding acquisition of a permanent wall easement and temporary construction easement at 1508 Heritage Garden Street for the South Franklin Street Widening project.
Second: Commissioner Sliwinski.
Vote: Motion carried 5-0.

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ACTION:
Mover: Commissioner Wright made a motion to approve a resolution of the Board of Commissioners regarding acquisition of a permanent wall easement and temporary construction easement at 1512 Heritage Garden Street for the South Franklin Street Widening project.
Second: Commissioner Sary.
Vote: Motion carried 5-0.

ACTION:
Mover: Commissioner Wright made a motion to approve a resolution of the Board of Commissioners regarding acquisition of a permanent wall easement and temporary construction easement at 1516 Heritage Garden Street for the South Franklin Street Widening project.
Second: Commissioner Sliwinski.
Vote: Motion carried 5-0.

5. Commissioner Reports

Commissioner Dyer attended the Historic Preservation Commission and will attend the Veteran's Memorial Event.

Commissioner Wright had no report.

Commissioner Sliwinski shared they had a debrief on the Mental Health Wellness Fair that was held on October 21st and shared there were 183 participants. He thanked Lisa Hayes, Andrew Brown, the vendor advocates who were there, and the staff at the Renaissance Centre.

Commissioner Shackleford had no report.

Commissioner Sary attended the Central Pines Regional Council in October. He attended the groundbreaking for the new Bus Rapid Transit (BRT) Station in Raleigh. He thanked all the Veterans. He stated that he takes issue with the comments that there's no transparency or opportunities for people to be involved. He thinks the Town is doing a great job.

Mayor Jones congratulated Jeanette Johnson for receiving the Garby Award for the North Carolina Chapter of the Solid Waste Association of North America. She also

thanked Marvin Weathers for speaking at the Success North Carolina Conference. She thanked Olivia Atkinson for her work in specialized programs. She said the Citizens Academy finished and is a great program and is another way we are giving information to the citizens. Mayor Jones also extended her gratitude to staff who assisted with the Halloween Boo Bash, public needs for the PRCR Plan, and the dance festival. Mayor Jones attended the BW Wells Annual Meeting, and the 100th Birthday Bash at Wake Forest Elementary School.

Town Manager Kip Padgett thanked Public Facilities for lighting up Town Hall in honor of Veteran's Day.

6. Adjournment

The Board of Commissioners adjourned the meeting at 8:43 p.m.

Duly approved in open session this 19th day of December 2023.

(ATTEST)

_____
Vivian A. Jones, Mayor

_____
Theresa Savary, Town Clerk

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Wake Forest Board of Commissioners
Meeting Minutes

The Wake Forest Board of Commissioners met on **Tuesday, November 21, 2023,** at **6:00** p.m. in the Board Room at Wake Forest Town Hall, 301 S Brooks Street.

Mayor Jones called the meeting to order at 6:00 p.m.

Mayor Jones led everyone in the Pledge of Allegiance.

Council Members Present: Mayor Vivian A. Jones, Commissioner Jim Dyer, Commissioner Sary, Commissioner Keith Shackleford, Commissioner Adam Wright, and Commissioner Nick Sliwinski.

Commissioner Members Absent: None.

Staff Members Present:

Town Manager Kip Padgett
Assistant Town Manager Candace Davis
Assistant Town Manager Allison Snyder
Assistant Town Manager/CFO Aileen Staples
Finance Director Samantha Sanchez
Town Attorney Hassan Kingsberry
Town Clerk Theresa Savary
Legal Services Intern Aaliyah Lecompte
Planning Director Courtney Tanner
Senior Planner Patrick Reidy
Senior Civil Engineer Chris Glass
Assistant Stormwater Engineer Nick Nolte
Police Chief Jeff Leonard
Police Captain Julius Jefferson
Police Captain Brandon High

1. Approval of Agenda

ACTION:
Mover: Commissioner Shackleford moved to approve the agenda as presented.
Seconder: Commissioner Dyer.
Vote: Motion carried 5-0.

2. Approval of Minutes

2.A. Approval of Minutes:
- October 3, 2023 Work Session
- October 17, 2023 Regular Meeting

ACTION:
Mover: Commissioner Dyer moved to approve the minutes as presented.
Seconder: Commissioner Wright.
Vote: Motion carried 5-0.

3. Presentations

3.A. Presentation of fiscal year ended June 30, 2023 Annual Comprehensive Financial Report

Finance Director Samanta Sanchez shared that FY2023 was an excellent year, financially. She introduced April Adams with Cherry Bekaert, LLP.

April Adams spoke about the financial details of the Annual Comprehensive Financial Report (ACFR) including the external auditor's role and results, required communications, and financial performance highlights.

Ms. Sanchez wrapped it up with a few final items:
- Financial Performance Indicator of Concern (FPIC)
  - Electric fund cash
- Single Audit finding
  - Interest earned on Powell Bill funds
- Certificate of Achievement of Excellence in Financial Reporting from the GFOA
  - 33rd consecutive year
- Popular Annual Financial Report (PAFR)– Citizens Report
  - Questions/Discussion

Commissioner Dyer asked about the recent electrical rate increases. Ms. Sanchez explained that it would take several cycles to generate the revenue.

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Mayor Jones asked if there were any other questions. No other questions were heard.

A hardcopy of the Annual Comprehensive Financial Report (ACFR) is filed and available in the Town Clerk's Office for review.

3.B. Resolution Recognizing Sergeant David Doherty on his Retirement

Mayor Jones recognized a Resolution of Appreciation for the Services of Sergeant David Doherty.

RESOLUTION 2023-64
RESOLUTION OF APPRECIATION
FOR THE SERVICES OF
Sergeant David Doherty

WHEREAS, Sergeant David Doherty was hired as a Police Officer I in January of 2008 and served as a sworn member of the Wake Forest Police Department for over 15 years with a retirement date of September 11, 2023; and
WHEREAS, Doherty was promoted to Police Corporal in January of 2015; and
WHEREAS, Doherty was promoted to Police Sergeant in February of 2017; and
WHEREAS, Doherty received many hours of training and served in a variety of positions within the Wake Forest Police Department including Sergeant of the Criminal Investigation Division, Internal Affairs Investigator, an interview panelist on the oral review board for new hires; and
WHEREAS, Doherty served unselfishly as a law enforcement officer for the good of the Town of Wake Forest, making sacrifices in personal and family ties;
NOW, THEREFORE, BE IT RESOLVED by the Board of Commissioners of the Town of Wake Forest, North Carolina, that Sergeant David Doherty is hereby officially commended by this Board on behalf of the citizens of Wake Forest for valuable and outstanding service rendered to the Town of Wake Forest Police Department in his official capacity as a Police Sergeant.
BE IT FURTHER RESOLVED that this resolution be made a part of the permanent records of the Town of Wake Forest and that a copy of this resolution is presented to Sergeant Doherty.
This the 21st day of November 2023.

3.C. Introduction of Candidates for the Board of Adjustments and Planning Board

Mayor Jones recognized the following Board of Adjustment applicants:

- Matthew Burg

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- Craig Chalkley
- Erlinda Laska
- Joseph Longoria
- Andrew Martino

Matthew Burg introduced himself to the Board of Commissioners and expressed his interest in service to the Board of Adjustment.

Craig Chalkley introduced himself to the Board of Commissioners and expressed his interest in service to the Board of Adjustment.

Andrew Martino introduced himself to the Board of Commissioners and expressed his interest in service to the Planning Board.

Matt Davis introduced himself to the Board of Commissioners and expressed his interest in service to the Board of Adjustment.

4. Public hearings / Public Comment

4.A. Public Hearing on LEGISLATIVE CASE RZ-23-02, Stadium Drive Mixed Use, a rezoning filed by Williams Mullen to rezone 19.30 acres located at 0 Stadium Dr, being Wake County Tax PIN 1831957846 from Rural Holding District (RD), Richland Creek Watershed Management Area District (RC-WMA), and Special Highway Overlay (SH1-O) to Neighborhood Mixed-Use Conditional District (NMX-CD), Richland Creek Watershed Management Area District (RC-WMA), and Special Highway Overlay (SH1-O).

The following citizen provided public comment:
Margaret Watkins, who resides at 407 Belmellen Ct. in Wake Forest, NC 27587, expressed her satisfaction with the developer's efforts in collaborating with the HOA and neighboring property owners. However, she emphasized that for her to fully support this development, she would like to see an improved intersection at the shopping center.

Applicant Tom Johnson with Williams Mullen provided an overview of the project, discussing the site plan, future road alignment, treatment of additional stormwater,

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additional environmental conservations, retail incubator space, and displaying renderings. Mr. Mullens also provided details on additional and modified conditions.

Mayor Jones asked if anyone else would like to speak. No one else came forward to speak.

Mayor Jones declared the public hearing closed.

4.B. Public Hearing on Stormwater Utility Fee

Assistant Stormwater Engineer Nick Nolte provided an overview of the Stormwater Utility Fee Advisory Group recommendations. He stated with the changes to the Code of Ordinances Town Staff has decided to consolidate all their stormwater regulations into Chapter 14 of the Code of Ordinances. This chapter includes a civil penalty section that requires two votes and two readings.

Mayor Jones inquired whether townhomes are considered residential or commercial. Mr. Nolte stated that non-residential would include multi-family with five or more residential units. Therefore, if it falls under that category, they will consider it multi-family.

The following citizen provided public comment:

- Margaret Watkins, 407 Belmellen Ct., Wake Forest, NC 27587 inquired about the calculation method used for driveways and walkways. She also expressed her concern about the Board voting on this item tonight. Ms. Watkins asked about the availability of credits for those who are financially struggling and believes it needs to be addressed before the Board makes a decision.

Mayor Jones asked if anyone else would like to speak. No one else came forward to speak.

Mayor Jones declared the public hearing closed.

4.C. Public Hearing on Community Plan Amendment related to the Wake Forest/Raleigh Utility Merger Agreement (CPA-23-03)

Planning Director Courtney Tanner stated the purpose of this amendment is to provide

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staff, the Planning Board, and the elected body guidance should anyone bring forward an annexation request as well as a rezoning request to receive water and/or sewer. She said staff are currently drafting UDO standards for conservation subdivisions. This is an interim measure to help protect and ensure compatibility until those are adopted.

Commissioner Wright asked if this is considered a rezoning. Ms. Tanner replied, no.

Commissioner Wright asked if there would ever be a lower zone than General Residential as far as density. Ms. Tanner explained, that in the new UDO, there are no density provisions. She said the goal is to focus on design, not density. It's too early to tell what all the zoning districts will be.

Commissioner Wright asked what would happen if they didn't do this. Ms. Tanner replied, worst case scenario is you'd end up with incompatible uses in this area.

Commissioner Wright asked what the steps would look like if they asked for a new zone in the UDO. Ms. Tanner replied that it could potentially cost more time and money, according to state statute their UDO needs to be developed by using the Community Plan as a guide, and there could potentially be inconsistencies.

Commissioner Wright asked if the current landowners Andy Ammons and Ms. Willis have any plans to do any type of building out there. Ms. Tanner stated she has spoken to both property owners and one property owner said she made a promise to her grandmother that the property would remain as is and she intends on keeping that promise. Ms. Tanner said she made it clear that if something were to happen and the land was given to her children, she couldn't guarantee what would occur. Ms. Tanner said Mr. Ammons develops land and that is what he does for a living so she can't guarantee he doesn't have some application in the future.

Commissioner Sliwinski asked if the amendment would change, remove, or amend a watershed overlay district. Ms. Tanner replied there are state and local requirements, and Wake Forest and Wake County have requirements. Those remain in place and don't change as a result of this.

Commissioner Wright asked if the main purpose besides guidance is to be able to help better conservation of the land. Ms. Tanner said if it were to be developed it should be

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developed under the conservation provisions that are being drafted in the UDO.

The following citizens provided public comment:

- Peter Pascucci, 1539 Monterey Bay Dr., Wake Forest, NC 27587 expressed his concerns regarding CPA-23-03
- Kate Olsen, 1108 Dunn Creek Crossing, Wake Forest, NC 27587 expressed her concerns regarding CPA-23-03
- Robb Olsen, 1108 Dunn Creek Crossing, Wake Forest, NC 27587 expressed his concerns regarding CPA-23-03
- Linda Puschauver, 1460 Santa Lucia St., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Frank Walker, 1440 Santa Lucia St., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Lori Walker, 1440 Santa Lucia St., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Susan Pavlik, 1321 Monterey Bay Dr., Wake Forest, NC 27587 said in reference to the submitted staff report she requested clarification of the final statement made under staff recommendation
- Janice Davis, 1009 Lightfoot Ct., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Randy Willis, 1113 Bilbury Ct., Raleigh, NC 27614 spoke in opposition to CPA-23-03
- Lynn Rannels, 7221 Rusted Oak Rd., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Laura Bowen, 1550 Santa Lucia St., Wake Forest, NC 27587 expressed her concerns regarding CPA-23-03
- Don Bowen, 1550 Santa Lucia St., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- William Haldin, 1525 Ridgeway Bluff Ct., Wake Forest, NC spoke in opposition to CPA-23-03
- Debra Ludas, 5132 Mid Ridge Ct., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Marty Ludas, 5132 Mid Ridge Ct., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Margaret Watkins, 407 Belmellen Ct., Wake Forest, NC 27587 spoke in support to CPA-23-03

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- Barbara Cather, 1510 Santa Lucia St., Wake Forest, NC 27587 spoke about the Community Plan and hopes the Town uses the guidance of the plan.
- Mark Opfell, 1021 Mendocino St., Wake Forest, NC 27587 spoke in opposition to CPA-23-03
- Ellen Fischbein, 1001 Mendocino Drive expressed her concerns regarding CPA-23-03

Mayor Jones asked if anyone else would like to speak. No one else came forward to speak.

4.D. Public Comment: If anyone would like to address the Board of Commissioners on an item other than a public hearing item during the time of public comment, please sign up with the Town Clerk prior to the meeting. Each speaker is asked to limit comments to 3 minutes. Please provide the clerk with copies of any handouts you have for the Board. Although the Board is interested in hearing your concerns, speakers should not expect Board action or deliberation on subject matter brought up during the Public Comment segment. Topics requiring further investigation will be referred to the appropriate Town Staff and may be scheduled for a future agenda. Thank you for your consideration of the Board of Commissioners, staff and other speakers.

The following citizen provided public comment:

- Margaret Watkins, 407 Belmellen Ct., Wake Forest, NC 27587 believes that there may have been a misunderstanding when she stated that more transparency and answers from staff were needed before appearing before the Board. What she meant by "lack of transparency" was that individuals may not be well-informed. If her previous statement gave anyone the wrong impression, she apologizes for any confusion.

Mayor Jones asked if anyone else would like to speak. No one came forward to speak.

5. Consent Agenda

(A Consent Agenda is a group of items passed with a single motion and vote. These matters are of a generally routine nature. No debate is allowable on any item included on the Consent Agenda. If a commissioner or any citizen of Wake Forest or its ETJ wants separate consideration of any item, it may be removed from the Consent Agenda by request.)

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5.A. Approval of a Resolution to surplus the badge and service weapon carried by Sergeant David Doherty

[Filed in the Clerk's Office as Resolution 2023-63.]

5.B. Approval of Appointment to Citizen Advisory Boards

[Filed in the Clerk's Office as Resolution 2023-68 (HRC), 2023-69 (PAC], 2023-70 (PRCR), 2023-71 (TAB), 2023-72 (UFB)].

5.C. Approval of Smith Creek Reservoir Design

[Filed in the Clerk's Office as Resolution 2023-62.]

5.D. Approval of Supplemental Service Agreement with Mott MacDonald on Resurfacing Project FY 23-24

[Filed in the Clerk's Office as Resolution 2023-65.]

5.E. Approval of reimbursement agreement between the Town of Wake Forest and Taylor Morrison of Carolinas, Inc.

[Filed in the Clerk's Office as Resolution 2023-67.]

5.F. Approval of a resolution authorizing the execution and delivery of an installment financing agreement with JP Morgan Chase Bank to finance the resurfacing and rehabilitation of certain town streets

[Filed in the Clerk's Office as Resolution 2023-66.]

ACTION:
Mover: Commissioner Dyer moved to approve the consent agenda as presented.
Seconder: Commissioner Wright.
Vote: Motion carried 5-0.

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6. Legislative Items

6.A. Consideration of Stormwater Utility Fee

ACTION
Mover: Commissioner Sary moved to approve as read into the record.
Seconder: Commissioner Dyer.

Mayor Jones thanked the Advisory Board for their work on this item.

Commissioner Sary appreciates the fairness and diversity of the Board.

Vote: Motion carried 5-0.

6.B. Appointment of Candidates for the Board of Adjustment

ACTION
Mover: Commissioner Wright moved to approve as read into the record.
Seconder: Commissioner Dyer.
Vote: Motion carried 5-0.

7. Planning Items

7.A. Consideration of LEGISLATIVE CASE RZ-23-02, Stadium Drive Mixed Use, a rezoning filed by Williams Mullen to rezone 19.30 acres located at 0 Stadium Dr, being Wake County Tax PIN 1831957846 from Rural Holding District (RD), Richland Creek Watershed Management Area District (RC-WMA), and Special Highway Overlay (SH1-O) to Neighborhood Mixed-Use Conditional District (NMX-CD), Richland Creek Watershed Management Area District (RC-WMA), and Special Highway Overlay (SH1-O).

ACTION:
Mover: Commissioner Sary moved to approve Case RZ-23-02, Stadium Drive, with the consistency statement.
Seconder: Commissioner Shackleford.

Commissioner Sliwinski asked about the potential of a traffic light at the intersection. Mr. Reidy stated part of the issue is the realignment that must happen for both the current development under consideration and the shopping center. Mr. Reidy also said the Traffic Impact Analysis (TIA) didn't warrant it

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and NCDOT didn't make a request for the signal. Commissioner Sliwinski asked about a crosswalk. Mr. Reidy replied they have other locations and sometimes NCDOT approves it and may add additional signage, striping, pavement markings, or flashing beacons. He said that has a pretty good chance of being approved in some manner. Commissioner Sliwinski said he understands the developer worked with the neighbors and that's fantastic but he's having trouble getting past a potentially dangerous intersection. Commissioner Wright agreed but said when he looks at the development itself, he loves mixed-use. Unfortunately, with the intersection and not knowing fully what they're doing on Capital Blvd. he's not comfortable doing anything with that right now.

Vote: motion carried 3-2.

Aye	Nay
Chad Sary	Adam Wright
Jim Dyer	Nick Sliwinski
Keith Shackleford	

7.B. Consideration of Community Plan Amendment related to the Wake Forest/Raleigh Utility Merger Agreement (CPA-23-03)

Commissioner Wright asked, based on the feedback received at the public hearing by Mr. Olsen would it be possible to make those three changes and what would the process involve in doing so. Ms. Tanner explained the procedures and the limitations in terms of what could be modified.

ACTION:
Commissioner Wright recommended tabling the discussion until they can have further impact.
Seconder: Commissioner Dyer.

Commissioner Sliwinski expressed concern about tabling it and being left hanging out there without any protection.

Commissioner Sary expressed his concerns and believes it would be better protected if the Town were able to facilitate things that happen in the future. He doesn't think Wake County has their best interest in mind.

Commissioner Dyer withdrew his motion to second.

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Commissioner Shackleford said at least there is one property owner who has no intention of coming before the Board asking for a rezoning request, which means to him that a large portion of that property would remain intact as a forest.
Commissioner Shackleford would like to see the expansion of the description of the whole area.
Commissioner Sliwinski commented that this does not expand the ETJ nor the Town's jurisdiction, and at this point, they're not rezoning and are not putting a zoning classification on it; additionally, if someone wanted to build under R 80W zoning within the county they could still do that.

The motion died due to a lack of second.

ACTION:
Commissioner Shackleford made a motion to approve with changes in the wording, strike exhibit #2, and update cover.
Seconder: Commissioner Sary.

Commissioner Shackleford commented that he's heard everything that's been said and if this was to come before the Board at a later date, he's in full support of the conservation of the property.

Vote: Motion carried 4-1.

Aye	Nay
Chad Sary	Adam Wright
Jim Dyer	
Keith Shackleford	
Nick Sliwinski	

8. Administration and Financial Items

No Administration and Financial Items presented.

9. Public Services Items

No Public Service Items presented.

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10. Parks and Recreation Items

No Parks and Recreation Items presented.

11. Public Safety Items

No Public Safety Items presented.

12. Other Business

1. Mayor Jones brought before the Board a resolution for Wake Forest to support a study to accelerate the upgrade of US-1 between I-540 and Franklin County to a multimodal freeway using toll revenue.

ACTION
Mover: Commissioner Sary moved to approve a resolution for Wake Forest to support a study to accelerate the upgrade of US-1 between I-540 and Franklin County to a multimodal freeway using toll revenue.
Seconder: Commissioner Sliwinski.
Vote: Motion carried 5-0.

Town Manager Padgett recognized Joe Milazzo, Executive Director of the Regional Transportation Alliance, in the audience. Mr. Padgett stated that the Alliance represents the business community in the triangle and has passed a similar resolution.

Mayor Jones attributed the idea to Mr. Milazzo, emphasizing his instrumental role in bringing it forward.

2. Town Manager Padgett brought before the Board Resolution 2023-73 to acquire property at 1621 and 1701 Wait Avenue for approval.

ACTION
Mover: Commissioner Dyer moved to approve Resolution 2023-73 authorizing to acquire property located at 1621 and 1701 Wait Avenue.
Seconder: Commissioner Sliwinski.
Vote: Motion carried 5-0.

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12.A. Department Monthly Report

Received.

12.B. Wake County Tax Release

Received.

12.C. Commissioner Reports

Mayor Jones announced the sad news of the passing of County Commissioner James West. She expressed her condolences and shared that he was a kind and wonderful man who served his district with great dedication for many years. He was a remarkable commissioner and public servant. The Mayor expressed her regret at this news.

Commissioner Dyer attended the Wake Forest Cares Holiday Kick-off.

Commissioner Wright attended the 10th Anniversary Gala at the Renaissance Centre, and the ribbon cutting at Broadside and Brews.

Commissioner Sliwinski attended the 10th Anniversary Gala at the Renaissance Centre and praised Debbie Dunn and her team for organizing a phenomenal event. He attended the Wake Forest Cares Holiday Kick-off and had the opportunity to meet and talk with second graders at Richland Creek Elementary School.

Commissioner Shackleford attended the 10th Anniversary Gala at the Renaissance Centre and complimented the staff for their great work in organizing the 10th Anniversary Gala. He also attended the Wake Forest Cares Holiday Kick-off.

Commissioner Sary met Joey Hopkins from NCDOT and attended the Central Pines Regional Council Board Delegates Meeting.

Mayor Jones attended the 2023 State of the County at PNC Arena, the North Carolina League of Municipalities Legislative Policy Committee Meeting, the Wake Forest Chamber of Commerce Entrepreneurs Academy, and the Wake Forest Cares Holiday Kick-off. The Senior Center sent a thank-you card signed by many people, expressing gratitude to the Town of Wake Forest for amending their budget to include a little more

money for the Senior Center. She also attended the 10th Anniversary Gala at the Renaissance Centre, and she enjoyed meeting and talking to the second graders at Richland Creek Elementary School.

Town Manager Padgett recognized Parks, Recreation & Cultural Resources for receiving reaccreditation from the Commission for Accreditation of Park and Recreation Agencies (CAPRA).

12.D. Consultation with the Town Attorney, N.C.G.S. § 143.318.11(a)(3)".

ACTION:
Mover: Commissioner Wright moved to go into closed session at 8:30 p.m.
Seconder: Commissioner Sary.
Vote: Motion carried 5-0.

The Board reconvened to open session at 9:10 p.m.

13. Adjournment

With no further business to discuss, the meeting was adjourned at 9:11 p.m.

Duly approved in open session this 19th day of December 2023.

(ATTEST) _____ Vivian A. Jones, Mayor

_____
Theresa Savary, Town Clerk

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Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-314-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Public Comment: If anyone would like to address the Board of Commissioners on an item other than a public hearing item during the time of public comment, please sign up with the Town Clerk prior to the meeting. Each speaker is asked to limit comments to 3 minutes. Please provide the clerk with copies of any handouts you have for the Board. Although the Board is interested in hearing your concerns, speakers should not expect Board action or deliberation on subject matter brought up during the Public Comment segment. Topics requiring further investigation will be referred to the appropriate Town Staff and may be scheduled for a future agenda. Thank you for your consideration of the Board of Commissioners, staff and other speakers.

Recommendation:

Item Summary:

ATTACHMENTS

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-302-
Submitted by: Emma Linn
Submitting Department: Planning
Meeting Date: December 19, 2023

SUBJECT
Approval of a resolution to schedule the public hearing and certify the sufficiency for a petition requesting annexation submitted by Marion Jordan C/O Edward and Louise Smith for property associated with the rezoning request RZ-23-07, located at 200 Stephen Taylor Road, being Franklin County PINs 1842-82-6404 (parent PIN) and 1842-82-7362 (secondary PIN) being approximately 1.008 acres

Recommendation:

Item Summary:

ATTACHMENTS

- 121923 BOC Agenda Summary AN-23-04.pdf
- Attachment A Legal Description AN-23-04.pdf
- Attachment B Annexation Map AN-23-04.pdf
- Attachment C Contiguous Annexation Petition AN-23-04.pdf
- Attachment D Agent Authorization Form AN-23-04.pdf
- CERTIFICATE OF SUFFICIENCY .docx
- DRAFT PUBLIC HEARING RESOLUTION.docx

Agenda Item: Approval of a resolution to schedule the public hearing and certify the sufficiency for a petition requesting annexation submitted by Marion Jordan C/O Edward and Louise Smith, for property associated with the rezoning request RZ-23-04, located at 200 Stephen Taylor Road, being Franklin County PINs 1842-82-6404 (parent PIN) and 1842-82-7362 (secondary PIN) being approximately 1.008 acres.

Summary: The property proposed for annexation is contiguous to the corporate limits of the Town of Wake Forest. The proposed annexation is associated with rezoning case RZ-23-07.

Staff is requesting that the Board accept the petition, adopt the resolution to investigate the annexation petition, certify the sufficiency of the annexation petition, and adopt the resolution setting the public hearing date for the annexation petition.

Attachments: Attachment A Legal Description AN-23-04
Attachment B Annexation Map AN-23-04
Attachment C Contiguous Annexation Petition AN-23-04
Attachment D Agent Authorization Form AN-23-04
Certificate of Sufficiency
Draft Public Hearing Resolution

WILLIAM T. DEMENT, JR.
Professional Land Surveyor, P.A.
Physical Address: 102 West Nash Street, Suite D **Mailing Address: P.O. Box 701** Email Address: DementSurvey@nc.rr.com
LOUISBURG, N.C. 27549
Tel.: (919)496-6159

May 23, 2023

Re: Marion S. Jordan Rezoning & Annexation Request

DESCRIPTION OF LOTS TO BE ANNEXED INTO TOWN OF WAKE FOREST, NC

Being all of those certain two lots located on NCSR 1161 (Stephen Taylor Road) and Haltwhistle Street, Youngsville Township, Franklin County, NC, presently owned by Edward B, Smith, et ux, according to Franklin County GIS department and Deed Book 1702, Page 478, Franklin County Register of Deeds office and being more particularly described as follows:

LOT 2A

Beginning at a found 5/8" iron rebar w/top flush w/ground located at the southwest intersection of the right-of-ways of NCSR 1161 (Stephen Taylor Road)(60' R/W) and Haltwhistle Street (60' R/W), said iron rebar having a coordinate value of N 822,468.57 feet and E 2,148,721.00 feet;

thence, along the western right-of-way line of NCSR 1161 (Stephen Taylor Road), a curve to the left having a chord bearing and distance of S 28°50'15"W 135.82', a radius of 714.03' and an arc length of 136.03' to a found 3/8" iron pipe w/top 3" below ground, a corner of Joseph A. Ivey, et ux property;

thence, leaving said western right-of-way line and along the Joseph A. Ivey, et ux property N 66°27'55"W 88.77' to a found ½" iron pipe w/top 9" below ground and S 82°28'30"W 123.21' to a found 5/8" iron rebar w/top 5" below ground, a corner of Everly Subdivision;

thence, along Lot 167, Everly Subdivision N 40°12'05"E 142.33' to a found ½" iron pipe w/top 9" above ground;

thence, along Lot 168, Everly Subdivision N 40°12'05"E 50.98' to a found Mag nail w/top flush in a 15" tree stump 10" above ground, N 09°44'00"E 26.15' to a set 5/8" iron rebar w/top flush w/ground and N 38°12'25"E 28.36' to a found 5/8" iron rebar w/top 7" above ground and 0.6' south of the edge of a concrete sidewalk in the southern right-of-way line of Haltwhistle Street (60'R/W);

thence, along the southern right-of-way line of Halwhistle Street S 51°51'40"E 155.51' to the point and place of beginning, containing 0.630 acre, more or less, according to a survey and plat by William T. Dement, Jr., PLS dated 2/14/23.

LOT 2B

Beginning at a found ½" iron pipe w/top 2" above ground in the eastern right-of-way line of NCSR 1161 (Stephen Taylor Road) (60' R/W), a corner for Martin W. Cliff, et als, said iron pipe having a coordinate value of N 822,448.44 feet and E 2,148,780.68 feet;

thence, leaving said eastern right-of-way line along the Martin W. Cliff, et als property S 19°14'25"E 211.46' to a found 1.5" iron bar w/top 7" above ground, a corner for Calvin A. Ray, Jr., et al and Paul D. Hicks, et al;

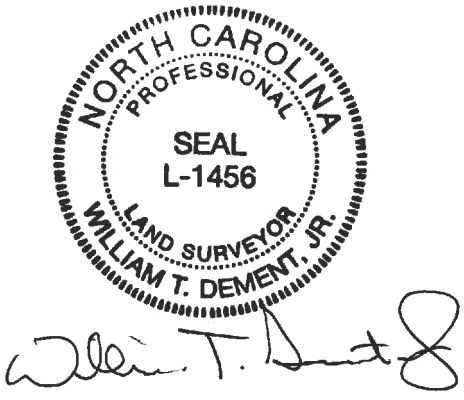
thence, along the Paul D. Hicks, et al property N 76°46'35"W 192.61' to a nail set at the base of a found ½" bent iron pipe w/top flush in a private gravel street in the line of Joseph A. Ivey, et ux property;

thence, N 25°35'45"E 49.20' to a set ½" iron rebar w/top flush w/gravel, a corner for Joseph A. Ivey, et ux, located near the end of NCDOT maintenance of NCSR 1161 (Stephen Taylor Road);

thence, S 66°37'25"E 28.76' to a found ½" bent iron pipe replaced with a 5/8" iron rebar w/top flush w/ground in the eastern right-of-way line of NCSR 1161 (Stephen Taylor Road);

thence, along said eastern right-of-way line of NCSR 1161 (Stephen Taylor Road) a curve to the right having a chord bearing and distance of N 29°46'35"E 141.29', a radius of 654.03' and an arc length of 141.57' to the point and place of beginning, containing 0.378 acre, more or less, according to a survey and plat by William T. Dement, Jr., PLS dated 2/14/23.

All coordinates and bearings shown hereon are based on the N.C. Grid System (NAD 83)(2011). All distances shown hereon are horizontal ground.



N.C. Grid North (NAD 83)(2011)

NORTH CAROLINA PROFESSIONAL SEAL L-1456 LAND SURVEYOR WILLIAM T. DEMENT, JR.

I, William T. Dement, Jr., certify that this plat was drawn under my supervision from an actual field survey made under my supervision (deed description recorded in Book 1702, Page 478); that the boundaries not surveyed are clearly indicated as drawn from information found in Plat Book 2005, Page 405; that the ratio of precision as calculated is 1/20,000; that this map was prepared in accordance with G.S. 47-30 as amended. Witness my original signature, license number and seal, this 14th day of February, 2023.

Professional Land Surveyor L-1456

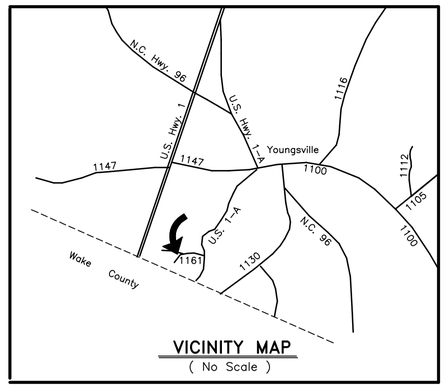
I, William T. Dement, Jr., certify that this plat is of a survey that creates a subdivision of land within the area of a county or municipality that has an ordinance that regulates parcels of land.

Professional Land Surveyor L-1456

I, William T. Dement, Jr., certify that this map was drawn by me from an actual GNSS survey made under my supervision and the following information was used to perform the survey:

(1) Class of survey: AA
(2) Positional accuracy: 0.02'
(3) Type of GNSS field procedure: Real-Time Kinematic
(4) Dates of survey: 2/14/23
(5) Datum/Epoch: NAD 83(2011)/2010.0000
(6) Published/Fixed control used: N.C.G.S. RTN, CORS
(7) Geoid model: 12B
(8) Combined grid factor(s): 0.99994360
(9) Units: US Feet

Professional Land Surveyor L-1456



VICINITY MAP
(No Scale)

Annexation Map: AN-23-04, 200 Stephen Taylor Road
1.008± Acres
Town of Wake Forest
Fulfills Requirements of N.C.G.S. 160A-29
Ordinance #
Adopted:
Effective Date of Annexation:

I, Theresa Savary, Town Clerk, Town of Wake Forest, North Carolina certify that this is a true and accurate map of annexation adopted the_____ day of_____, 20_____, by the Wake Forest Board of Commissioners. I set my hand and seal of the Town of Wake Forest.

_____, _____

_____
Theresa Savary

(168)
Now or Formerly
Aalap & Hetaswi Revocable Trust
(D.B. 2309, P. 909)

Everly Subdivision
(P.B. 2021, P. 285)

(167)
Now or Formerly
Yuhua Zhong, et ux
(D.B. 2308, P. 473)

Haltwhistle Street 60' Public R/W
(Asphalt Street)
60'
R/W
Concrete Sidewalk

Sunny Fields Drive 50' Public R/W
50'
(Asphalt Street)
R/W

(Stephen Taylor Road) 60' Public R/W
(Asphalt Road)
60'
R/W

N.C.S.R. 1161
(Asphalt Road)

(Gravel Road)

Found 5/8" Iron Rebar w/Top 7" Above Ground 0.6' From Edge Sidewalk
Set 5/8" Iron Rebar w/Top Flush w/Ground
Found Mag Nail w/Top Flush In 15" Tree Stump 10" Above Ground
Found 1/2" Iron Pipe w/Top 9" Above Ground
Found 3/8" Iron Pipe w/Top Flush w/Ground
Found 5/8" Iron Rebar w/Top 5" Below Ground
Found 1/2" Iron Pipe w/Top 9" Below Ground
Found 3/8" Iron Pipe w/Top 3" Below Ground
Found 3/8" Iron Pipe w/Top 3" Below Ground
Set 1/2" Iron Rebar w/Top Flush w/Gravel
Found 1/2" Bent Iron Pipe Replaced w/ 5/8" Iron Rebar w/Top Flush w/ Ground
Nail Set At Base of Found 1/2" Bent Iron Pipe w/Top Flush w/ Gravel
Found 1.5" Iron Bar w/Top 7" Above Ground
Found 1/2" Iron Pipe w/Top 2" A.G.
N.C. Grid Coordinates (NAD 83)(2011):
N 822,448.44
E 2,148,780.68

Found 5/8" Iron Rebar w/Top Flush
N.C. Grid Coordinates (NAD 83)(2011):
N 822,468.57
E 2,148,721.00

Stor. Bldg.
Deck
W.C. Ramp
C. Porch
Mobile Home

End of NCDOT Maintenance

N 38°12'25"E 28.36'
N 09°44'00"E 26.15'
S 51°51'40"E 155.51'
N 36°47'35"E 59.86'
S 19°17'55"E 72.11'
N 40°12'05"E 50.98'
N 40°12'05"E 142.33'
123.21' S 82°28'30"W
88.77' N 66°27'55"W
4.84'
S 66°37'25"E 26.34'
S 28.76' 66°37'25"E
N 25°35'45"E 49.20'
192.61' N 76°46'35"W
S 19°14'25"E 211.46'

L=136.03' R=714.03'
Chd.: S 28°50'15"W 135.82'
53.3'
40.8'
L=141.57' R=654.03'
Chd.: N 29°46'35"E 141.29'

2A
Area = 0.630 Acre
(Coordinate Method)

2B
Area = 0.378 Acre
(Coordinate Method)

Now or Formerly
Joseph A. Ivey, et ux
(D.B. 2089, P. 488)
(P.B. 2004, P. 342)

Now or Formerly
Martin W. Cliff, Jr., et als
(D.B. 2021, P. 556)
(P.R.F. 1, S. 194)

Now or Formerly
Paul D. Hicks, et al
(D.B. 1981, P. 953)
(P.B. 2007, P. 328)

Now or Formerly
Calvin A. Ray, Jr., et al

REFERENCES: Deed Book 1702, Page 478
Plat Book 2005, Page 405 – Tract 2
Tax Record No. 006387

LEGEND:
● . . . . found iron as noted
▲ . . . . found Mag nail as noted
○ . . . . set iron as noted
– – – – – – – – . . . . property line plotted from record

NOTE: All coordinates and bearings shown hereon are based on the N.C. Grid System (NAD 83)(2011). All distances shown are horizontal ground. Combined grid factor = 0.99994360

NOTE: Property is presently zoned R-30
Minimum building setbacks:
Front . . . 30', Side . . . 10', Rear . . . 25'

NOTE: This survey is subject to all easements, agreements, rights-of-way and restrictive covenants recorded prior to the date of this survey.

ANNEXATION MAP FOR

MARION S. JORDAN

(Property Owner – Edward B. Smith, et ux)(PIN No. 1842-82-6404)
200 Stephen Taylor Road, Wake Forest, Youngsville Township,
Franklin County, North Carolina

Scale: 1"=40' Date: February 14, 2023

40 0 40 80 120
GRAPHIC SCALE – FEET

NOTE: Owner's name shown for indexing purposes only and is not to be construed as title certification.

Surveyed & Mapped By
WILLIAM T. DEMENT, JR., Professional Land Surveyor, P.A.
L-1456, C-0649
(O)919-496-6159 (M)919-496-9502
102 West Nash Street Louisburg, N.C. 27549 (File No. 4041)

TOWN of
WAKE FOREST

Planning Department
Wake Forest Town Hall – 3rd Floor
301 S. Brooks Street
Wake Forest, NC 27587
t 919.435.9510
f 919.435.9539

CONTIGUOUS ANNEXATION PETITION APPLICATION

(Last updated: July 2013)

Submittal Date: 6-19-2023

To the Board of Commissioners of the Town of Wake Forest:

I/we the undersigned owner(s) of real property respectfully request that the area described in the paragraph below and as shown in the attached survey map of the property be annexed into the Town of Wake Forest.

The area to be annexed is contiguous to the Town of Wake Forest corporate limits and the boundaries of such territory are as follows *(attach or insert below a metes & bounds description with a matching survey map)*:

See attachments

Note: If ownership is a corporation or partnership, please provide such name and the name and signature of the person authorized to sign on behalf of the corporation or partnership. If in joint ownership, please provide names and signatures of ALL owners.

Name	Address	Signature	Date
* David L. Smith	15 Cannady Way Franklinton NC		7-25-2023
* Edward B. Smith	15 Cannady Way Franklinton NC		7-25-2023

For additional information or assistance, please call the Planning Department at (919) 435-9510.

Agent Authortization Form

TOWN of WAKE FOREST

The Wake Forest Unified Development Ordinance (UDO) states that applications for development approvals may only be made by the landowner, a lessee or person holding an option or contract to purchase or lease the land, or an authorized agent of the landowner (see). This agent authorization form must be signed by the landowner and included with any application not submitted by the landowner or lessee as specified above. If more than one landowner is involved, a separate agent authorization form must be submitted by each landowner.

Address(es) and Tax PIN(s) for which authorization is granted: 200 Steven Taylor Road Wake Forest NC 27587
Pin # 1842-82-6404

Landowner's name*: Louise T Smith & Edward B. Smith

Application(s) for which authorization is granted (e.g., Rezoning, Special Use Permit): Rezoning & Annexation

Person authorized to submit application(s) as landowner's agent *(must be the same person listed as the applicant on the application form)*: Marion S. Jordan

Landowner's Signature: X Louise T. Smith Edward B Smith

Date: 7/25/23

Please provide below the name, address, and other information of the person signing this form.

Name: Louise T Smith & Edward B Smith

Address: 15 Connady Way Franklinton NC 27525

Telephone number: (919) 494-7799

Email address: marion.smith44@yahoo.com

If signing for a corporation or other entity, please specify title and/or relationship to the corporation or other entity *(e.g., Member, Executive Officer)*:

**Owner of record as shown on the latest equalized assessment rolls of Wake County, or, if ownership has recently been transferred, the grantee shown on the recorded deed (a copy of the deed must accompany this form).*

CERTIFICATE OF SUFFICIENCY

To the Board of Commissioners of the Town of Wake Forest, North Carolina:

I, Theresa Savary, Town Clerk, do hereby certify that I have investigated the petition attached hereto and have found as a fact that said petition is signed by all owners of real property lying the area described therein, in accordance with N.C.G.S 160A-31.

In witness whereof, I have hereto set my hand and affixed the seal of the Town of Wake Forest, this the 19th day of December, 2023.

_____

Town Clerk

(SEAL)

RESOLUTION 2023-

RESOLUTION FIXING DATE OF PUBLIC HEARING ON QUESTION OF ANNEXATION PURSUANT TO N.C.G.S. 160A-31, AS AMENDED
(by Marion Jordan C/O Edward and Louise Smith for property associated with the rezoning request RZ-23-07, located at 200 Stephen Taylor Road being Franklin County PIN 1842-82-6404 being approximately 1.008 acres.)

WHEREAS, a petition requesting the annexation of the area described herein has been received; and

WHEREAS, the Board of Commissioners has by said resolution directed the Town Clerk to investigate the sufficiency of said petition; and

WHEREAS, certification by the Town Clerk as to the sufficiency of said petition has been made;

NOW, THEREFORE, BE IT RESOLVED by the Board of Commissioners of the Town of Wake Forest:

Section 1. That a public hearing on the question of annexation of the contiguous area described herein will be held at the Wake Forest Town Hall at 6:00 p.m. on the 16th day of January, 2024.

Section 2. The area proposed for annexation is described as follows:

(See Attachment A - Legal Description and Attachment B - Annexation Map)

Section 3. Notice of said public hearing shall be published once in the News and Observer, a newspaper having general circulation in the Town of Wake Forest, at least ten (10) days prior to the day of said public hearing.

Adopted and effective this the 19th day of December, 2023.

_____

Vivian A. Jones

Mayor

ATTEST:

_____

Theresa Savary

Town Clerk

APPROVED AS TO FORM:

_____

Hassan Kingsberry

Town Attorney

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-307-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Approval of the 2024 Board of Commissioners Meeting Schedule

Recommendation:

Item Summary:

ATTACHMENTS

- Resolution2023-75, 2024TOWFBoardOfCommissionersMeetingSchedule_Dec202319.pdf

Town of Wake Forest
Resolution 2023 – 75
2024 Town of Wake Forest Board of Commissioners Meeting Schedule

WHEREAS, the Wake Forest Board of Commissioners exists to conduct the business of the citizens; and

WHEREAS, the Wake Forest Board of Commissioners meetings are held the first and third Tuesday of the month at 6:00 p.m. in the Wake Forest Town Hall Board Room, 301 S. Brooks Street, unless otherwise noted; and

WHEREAS, each meeting of the Wake Forest Board of Commissioners is open to the public, except as provided by NC GS 143-318.11; and

WHEREAS, the Wake Forest Board of Commissioners may amend the yearly meeting schedule in accordance with NC GS 143-318.12:

Town of Wake Forest
2024 Calendar
Board of Commissioners Meetings

Month	Meeting #1	Meeting #2
January	January 2, 2024	January 16, 2024
February	February 6, 2024	February 20, 2024
March	March 5, 2024	March 19, 2024
April	April 2, 2024	April 16, 2024
May	May 7, 2024	May 21, 2024
June	June 4, 2024	June 18, 2024
July	July 2, 2024	July 16, 2024
August	August 6, 2024	August 20, 2024
September	September 3, 2024	September 17, 2024
October	October 1, 2024	October 15, 2024
November	November 5, 2024	November 19, 2024
December	December 3, 2024	December 17, 2024

Annual Retreat: January 19, 2024, 9:00 a.m. at the Wake Forest Renaissance Centre.

NOW THEREFORE BE IT RESOLVED that the Wake Forest Board of Commissioners hereby adopts the 2024 Town of Wake Forest Board of Commissioners Meeting Schedule as presented.

Duly adopted this 19th day of December 2023 while in regular session.

ATTEST:

Vivian A. Jones, Mayor

Theresa Savary, Town Clerk

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-282-
Submitted by: Aileen J. Staples
Submitting Department: Finance
Meeting Date: December 19, 2023

SUBJECT
Approval of Budget Ordinance Amendment # 1 - FY 2023 - 2024

Recommendation:
Approval as submitted

Item Summary:

ATTACHMENTS
- Budget Ordinance Amendment_summary.pdf
- Budget Ordinance Amendment # 1 FY 2023-2024.pdf

Agenda Item: Budget Ordinance Amendment # 1 – FY 2023-2024

Summary: North Carolina General Statutes 159-15 authorizes the governing board to amend the budget ordinance at any time after the ordinance is adopted. Amendments generally include additional revenues, appropriations from contingency for unforeseen events, transfers to/from capital reserve funds and/or fund balance and periodic modifications to capital projects funds.

Attachments: Summary worksheets

Budget Amendment # 1

General Fund
Budget Amendment Worksheet
For the fiscal year ending June 30, 2024

Estimated Revenues:	Dept.	Budget Adopted	Prior Budget Amendments	Current Budget Amendments	Amended Budget
General Fund revenues		$ 68,581,250	-		68,581,250
Total Revenues		68,581,250	-	-	68,581,250
Appropriations:					
Board of Commissioners	410	417,500		53,385	470,885
Legal Services	412	396,200		1,400	397,600
Town Manager's Office	420	895,650		1,100	896,750
Town Clerk	421	250,500			250,500
Organizational Performance	422	474,180			474,180
Budget Management	423	232,785			232,785
Communications	425	1,288,400		4,400	1,292,800
Human Resources	430	1,162,910		20,000	1,182,910
Risk Management	431	467,730		16,000	483,730
Downtown Development	435	510,500		16,285	526,785
Financial Services	440	1,275,635		7,800	1,283,435
Information Technology	445	2,281,575			2,281,575
Inspections	480	2,408,475		2,700	2,411,175
Planning	490	3,333,975	931,275	54,175	4,319,425
Public Facilities	500	3,082,000		389,860	3,471,860
Public Safety: Police	510	16,185,550	142,625	41,000	16,369,175
Public Safety: Fire	520	12,668,250		34,900	12,703,150
Public Works:					
PW Administration	530	313,115			313,115
Urban Forestry	535	529,400		1,350	530,750
Fleet Maintenance	550	651,295		2,600	653,895
Streets	560	3,713,875	187,555	1,350	3,902,780
Solid Waste	580	5,985,500		1,300	5,986,800
Engineering	540	1,570,950	126,340	82,895	1,780,185
Stormwater Management	545	743,945	52,615		796,560
Parks, Recreation & Cultural Resources	620	6,208,965		45,000	6,253,965
Transfers	999	8,201,640			8,201,640
Total Appropriations		75,250,500	1,440,410	777,500	77,468,410
Estimated revenues over total appropriations		$ (6,669,250)	$ (1,440,410)	$ (777,500)	$ (8,887,160)
Other financing sources (uses):					
Sale of assets		450,000			450,000
Installment note proceeds		1,435,000			1,435,000
Operating transfers from other funds:					
Special Revenue Fund - DMSD		100,000		16,285	116,285
Special Revenue Fund - Police		40,500			40,500
Special Revenue Fund - Futures Fund					-
American Rescue Plan - ARPA Fund					-
Rec Capital Reserve Fund - Rec Impact Fees		591,750		45,000	636,750
Gen Capital Reserve Fund - Fire Impact Fees		1,265,000			1,265,000
Proceeds from NCCHIP Reserve		500,000			500,000
Appropriated Fund Balance		2,287,000	1,440,410	716,215	4,443,625
Total other financing sources		6,669,250	1,440,410	777,500	8,887,160
Estimated revenues and other sources over appropriations and other uses		$ -	$ -	$ -	$ -

NOTE: Prior budget amendment includes encumbrances brought forward from FY 22-23 as authorized by the FY 2023-2024 budget ordinance.

Budget Amendment # 1

Town of Wake Forest

Budget Amendment Request

For the fiscal year ending June 30, 2024

GENERAL FUND

	Funds coming from:					
	Fund	Dept	Account	Project/Department	Account Description	Amount
1	100	000	4990		Appropriated Fund Balance	336,855
2	100	000	4710	DMSD (400)	Interfund Transfers	16,285
3	100	000	4990		Appropriated Fund Balance	379,360
4	100	000	4710	Rec Cap Reserve (700)	Interfund Transfers (impact fees)	45,000
						777,500

Funds going to:					
Fund	Dept	Account	Project/Department	Account Description	Amount
100	410	5520	BOC	Contracted Services	2,185
100	410	5635	BOC	Special Events	1,200
100	410	5680	BOC	Cont - Resources for Seniors	50,000
100	412	5520	Legal Services	Insurance & Bonds	1,400
100	420	5520	Town Manager's Office	Insurance & Bonds	1,100
100	425	5520	Communications	Insurance & Bonds	4,400
100	430	5520	Human Resources	Insurance & Bonds	20,000
100	431	5520	Risk Management	Insurance & Bonds	16,000
100	440.350	5520	Fin Services - Admin	Insurance & Bonds	7,800
100	480	5520	Inspections	Insurance & Bonds	2,700
100	490.200	5520	Planning - Dev Services/Admin	Insurance & Bonds	2,100
100	490.200	5740	Planning - Dev Services/Admin	Cap Outlay - Equipment	52,075
100	500	5520	Public Facilities	Insurance & Bonds	10,500
100	510	5520	Police	Insurance & Bonds	41,000
100	520	5520	Fire	Insurance & Bonds	34,900
100	535	5520	Urban Forestry	Insurance & Bonds	1,350
100	540	5740	Engineering	Cap Outlay - Equipment	82,895
100	550	5520	Fleet Maintenance	Insurance & Bonds	2,600
100	560	5520	Streets	Insurance & Bonds	1,350
100	580	5520	Solid Waste	Insurance & Bonds	1,300
100	435	5498	Downtown Development	Façade Improvement Grants	3,500
100	435	5740	Downtown Development	Cap Outlay - Equipment	12,785
100	500	5700	Public Facilities	Property Acquisition (0 Brooks St)	134,855
100	500	5710	Public Facilities	Land (300 N White St)	244,505
100	620.400	5710	PRCR-Park Maintenance	Land (Devon Square - Earnest $)	45,000
					777,500

Explanation:

1 - Appropriate fund balance to amend budgets for unforseen expenditures, carry overs from FY 22-23 and allocated additional funding to Resources for Seniors (BOC approved).

2 - Allocated funds from DMSD for additional façade improvements and tree extension (carry over from FY 22-23).

3 - Appropriate fund balance for two property purchases - 0 Brooks St and 300 N White St (BOC approved).

4 - Appropriate funds from Recreation Impact Fees for earnest money deposit on Devon Square purchase (BOC approved).

Electric Fund
Budget Amendment Worksheet
For the fiscal year ending June 30, 2024

	Dept./ Div.	*Budget Adopted*	*Prior Budget Amendments*	*Current Budget Amendment*	*Amended Budget*
Estimated Revenues:					
Sale of Power		$22,390,900			$22,390,900
Other Revenue		2,112,100		125,000	2,237,100
Total revenues		24,503,000	-	125,000	24,628,000
Appropriations:					
Billing & Collections	840	575,820			575,820
Operations & Maintenance	850	23,890,635		125,000	24,015,635
Tree Trimming	860	618,545			618,545
Total appropriations		25,085,000	-	125,000	25,210,000
Estimated revenues over total appropriations		(582,000)	-	-	(582,000)
Other financing sources (uses):					
Operating transfer to other funds:					
Installment Purchase Proceeds		582,000			582,000
Tsfer from Cap Reserve		-			-
General Fund					-
Total other financing uses		582,000	-	-	582,000
Estimated revenues and other sources over appropriations and other uses		$ -	$ -	$ -	$ -

NOTE: Allocating funds from Contingency requires Board approval but does not affect budget totals.

Budget Amendment # 1

Town of Wake Forest

Budget Amendment Request

For the fiscal year ending June 30, 2024

ELECTRIC FUND

	Funds coming from:					
	Fund	Dept	Account	Project/Department	Account Description	Amount
1	360	000	4378	N/A	Development Proceeds	125,000
						125,000

	Funds going to:					
	Fund	Dept	Account	Project/Department	Account Description	Amount
	360	850	5721	Operations	Cap Outlay - Building Improvements	20,000
	360	850	5330	Operations	Professional Services - Engineer	50,000
	360	850	5740	Operations	Cap Outlay - System Improvements	55,000
						125,000

Explanation:

1 Recognize additional revenues and allocate to respective expense line items.

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-316-
Submitted by: Brad West
Submitting Department: Planning
Meeting Date: December 19, 2023

SUBJECT
Approval of the Town of Wake Forest Affordable Housing Land Disposition Program Policy

Recommendation:
Approval

Item Summary:

ATTACHMENTS

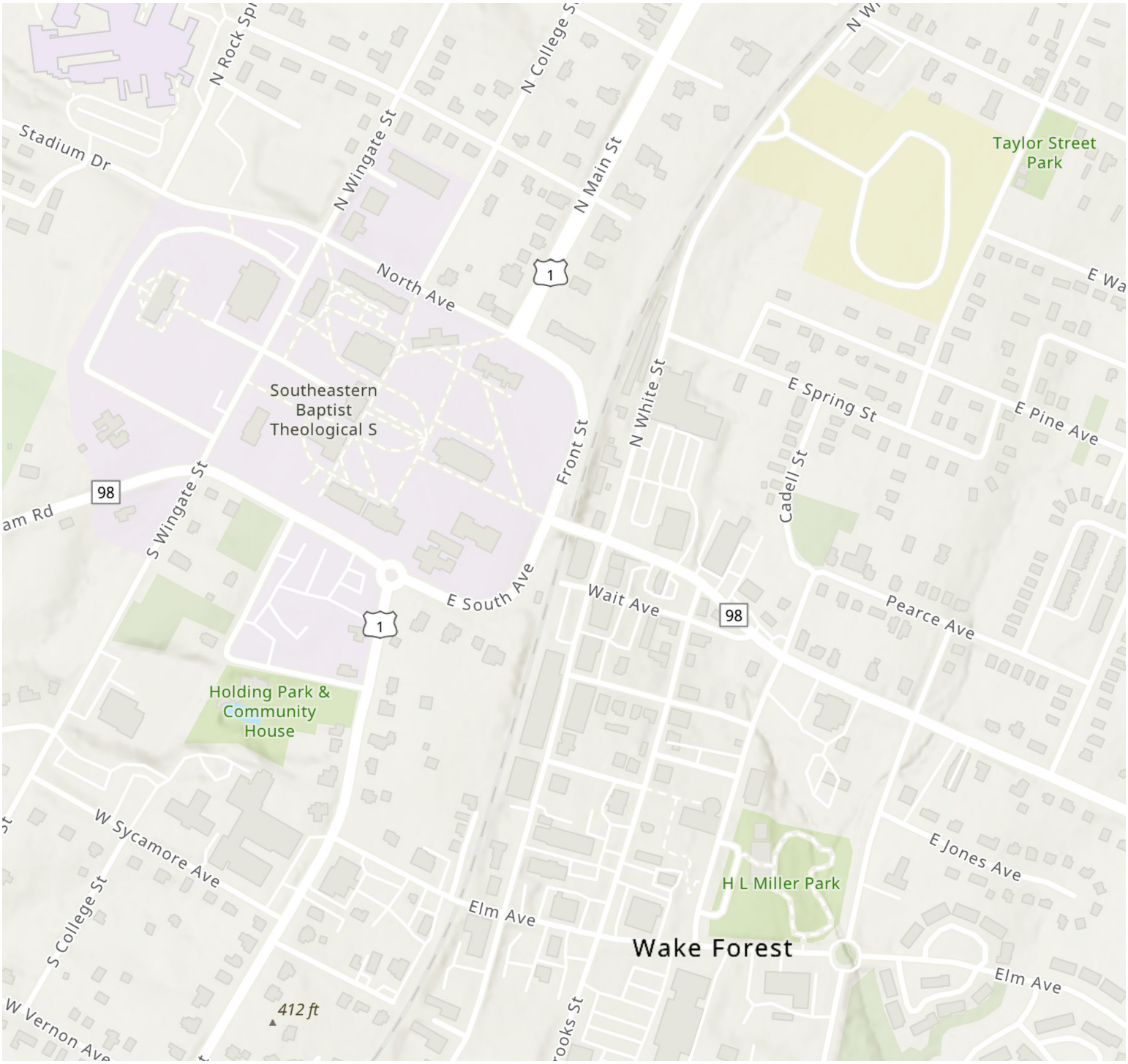
- 2023-316 Agenda Item Summary
- Exhibit A: Wake Forest Land Disposition Program Report
- Attachment 1: Appendix 1 - Town of Apex Affordable Housing Incentive Zoning Policy
- Attachment 2: Appendix 2 - Wake County Land Disposition Policy
- Attachment 3: Appendix 3 - Town of Wake Forest Land Disposition Request for Proposal Template
- 2023-316 Resolution.docx

Agenda Item: Approval of the Town of Wake Forest Affordable Housing Land Disposition Program Policy

Summary: The adopted 2022 Housing Affordability Plan calls for the creation of a Land Disposition Program that would involve the acquisition or conveyance of land for the purpose of creating affordable housing. BAE Urban Economics was hired to study the legal framework needed to create a program for Wake Forest for both acquisition and disposition of property, evaluate and determine appropriate Area Median Income (AMI) limits for the disposition program, review land disposition programs among other jurisdictions in the Triangle Area, including both approaches and lessons learned, and provide final recommendations for the Town's new program.

The information gathered by BAE Urban Economics was compiled into a final Land Disposition Program Report and presented to the Board of Commissioners at their December 5th 2023 work session. If approved, Staff will move forward with the creation of an Affordable Housing Land Disposition Program centered around the recommendations contained within the Report.

Attachments: Exhibit A: Wake Forest Land Disposition Program Report
Attachment 1: Appendix 1 - Town of Apex Affordable Housing Incentive Zoning Policy
Attachment 2: Appendix 2 - Wake County Land Disposition Policy
Attachment 3: Appendix 3 - Town of Wake Forest Land Disposition Request for Proposal Template



LAND DISPOSITION PROGRAM REPORT

Town of Wake Forest

DRAFT VERSION

Updated - November 27, 2023

Acknowledgment

The Town of Wake Forest's Land Disposition Program Report is informed, in large part, by various sources of research and expertise. This document would like to acknowledge the many peer community practitioners, service providers, development community members, elected leaders, and Town staff members involved in ensuring this document serves as an effective guide to creating a Land Disposition Program.

Peer Advisors

Alicia Arnold
Wake County Department of Housing Affordability and Community Revitalization

Dawn Fagan
Wake County Housing Authority

Dustin Engleken
Triangle Apartment Association

Jacquie Ayala
Habitat for Humanity

Joshua Johnson
St. Petersburg, FL Community Development Department

Rachel Eberhard
CASA

Rhett Fussell
Raleigh Area Land Trust

Shannon Cox
Town of Apex Planning Department

Tara Hall
North Carolina Housing Finance Agency

Yolanda Winstead
DHIC

Wayne Felton
Raleigh Housing Authority

Board of Commissioners

Vivian Jones
Mayor

Adam Wright
Commissioner

Chad Sary
Commissioner

Jim Dyer
Commissioner

Nick Sliwinski
Commissioner

R. Keith Shackleford
Commissioner

Project Consultants

BAE Urban Economics

Harry Johnson
Attorney

Legal Staff

Hassan Kingsberry
Town Attorney

Planning Staff

Courtney Tanner
Planning Director

Jennifer Currin
Assistant Planning Director

Brad West
Long Range Planning Manager

Michelle Michael
Senior Planner - Historic Preservation

Patrick Reidy
Senior Planner - Development Services

Kari Grace
Senior Planner - Development Services

Tim Richards
Senior Planner - Development Services

Emma Linn
Planner II - Long Range

Antione Jordan
Planner I - Long Range

Courtney Hotchkiss
Planner I - Historic Preservation

Nathan Smiley
Planner I - Development Services

Ben Coleman
Zoning Enforcement Officer

Kathryn Salisbury
Planning Technician

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Appendices

Appendix 1: Town of Apex Affordable Housing Incentive Zoning Policy

Appendix 2: Wake County Land Disposition Policy

Appendix 3: Land Disposition Request for Proposal Template

SECTION I

Introduction

The Town of Wake Forest engaged BAE Urban Economics to prepare an affordable housing land disposition program. The resulting program outlined and described herein includes a review of the State of North Carolina statutes and Town of Wake Forest ordinances to understand the legal framework in creating a program for Wake Forest for both acquisition and disposition of property, an evaluation and determination of appropriate Area Median Income (AMI) limits for the disposition program, a review of land disposition programs among other jurisdictions in the Triangle Area, including both approaches and lessons learned, and a set of final recommendations for the new program.

Recommendations include identifying criteria for evaluating potential affordable housing development sites, approaches to program administration, and program costs, as well as creating developer solicitation templates for Town use.

Background

In September 2022, the Board of Commissioners of the Town of Wake Forest adopted the Wake Forest Housing Affordability Plan. This plan, which focused on expanding housing opportunities in Wake Forest, recommended establishing a public land disposition program. Public land disposition is one way to make it easier and more feasible for housing developers to include affordable housing units. Under such a program, the Town can sell its publicly owned land to developers at a reduced price in exchange for the development of affordable homes. By reducing land costs, the developer is able to lower the amount of rent that is required to achieve feasibility. This strategy can also reduce the sales price of owner-occupied units.

The Town of Wake Forest retained BAE Urban Economics to help develop the Affordable Housing Land Disposition Program specifically seeking guidance on the following:

- Developing criteria and processes for acquiring and disposing of land for affordable housing development.
- Developing a Request for Proposals (RFP) template for potential public-private partnership deals involving public land disposition.
- Developing a proposal evaluation methodology for scoring potential deals involving public land disposition.
- Developing standard operating procedures outlining how Town staff should carry out and administer the proposed Land Disposition Program.
- Recommending an annual budget allocation for the effective execution of the Land Disposition Program, including funding for suitable parcels.

Methodology

In order to create a program that withstands legal scrutiny and supports affordable housing development, BAE began the analysis with a review of North Carolina statutory authority, followed by interviews with peer cities with existing programs and an analysis of best practices. The findings informed the creation of a developer solicitation (RFP) template, evaluation scoring criteria, a program approach, and annual budget.

SECTION SUMMARY

- Housing Affordability Plan calls for the creation of a land disposition program.
- BAE Urban Economics was asked to research the legal framework, targeted income levels, capacity, and standard operating procedures needed to implement this program.
- This Report summarizes these findings and recommends how the Town could move forward with a land disposition program.

SECTION II

Legislative Review

A review of the State of North Carolina statutes and local Town of Wake Forest ordinances provides the legal framework for creating a Town of Wake Forest Affordable Housing Land Disposition Program. Following are the legal requirements for disposition of property for housing and other uses, as well as for land acquisition.

Acquisition of Property

The State provides the power to local governments for the acquisition of property for housing and other development purposes. It prescribes the process and future uses for property obtained through eminent domain. The Town Charter itself also specifies methods for acquiring land through eminent domain. The following section describes relevant state and local law pertaining to the acquisition of land for future housing development.

Chapter 160A Cities and Towns (§160A-11: Corporate powers) enumerates the powers of any city to,

"…acquire and hold any property, real and personal, devised, sold, or in any manner conveyed, dedicated to, or otherwise acquired by them…"

as part of the corporate powers of a local jurisdiction**.**

Per **§160D-1303 Local governments authorized to acquire and reconvey real property**:

"Local governments (are) authorized to acquire and reconvey real property. Any local government may acquire by purchase, gift, grant, devise, lease, or otherwise, the fee or any lesser interest, development right, easement, covenant, or other contractual right of or to real property within its respective jurisdiction, when it finds that the acquisition is necessary to achieve the purposes of this Part. Any local government may also acquire the fee to any property for the purpose of conveying or leasing the property back to its original owner or other person under covenants or other contractual arrangements that will limit the future use of the property in accordance with the purposes of this Part, but when this is done, the property may be conveyed back to its original owner but to no other person by private sale."

§160D-1316 Low- and moderate-income housing programs further clarifies that any local government is authorized to,

"acquire real property by voluntary purchase from the owners to be developed by the local government or to be used by the local government to provide affordable housing to persons of low and moderate income."

Local governments also have acquisition authority under **§160D-1312 Acquisition and disposition of property for redevelopment**, which states that,

"independently thereof, and without the necessity of compliance with the Urban Redevelopment Law," local governments may "acquire by voluntary purchase from the owner(s), real property that is appropriate for housing construction or the economic development of the community"

Under **Chapter 157 Housing authorities law**, **§157-4.1 Alternative organization** – any city may exercise the powers enumerated to Housing Authorities within Chapter 157, even if another housing authority operates within the jurisdiction, as the Wake County Housing Authority does. The Board of Commissioners (BOC) acting as a housing authority can designate the responsibilities to any new or existing Town department. The statute does not specify whether responsibilities can be designated to an existing housing authority operating within a municipality's jurisdiction. Chapter 157 does give broad powers to a municipality to effectuate housing development and preservation; **§157-9 Powers of authority**, provides the Town with the ability to,

"purchase, lease, obtain options upon, acquire by gift, grant, devise, or otherwise any property real or personal or any interest therein from any person, firm, corporation, city, municipality, or government,"

and to acquire property for housing development use via eminent domain.

Outside of Chapter 157, §40A Eminent Domain in the North Carolina General Statutes oversees acquisitions and dispositions of properties obtained via eminent domain. While §40A -3 By whom right may be exercised expresses that a city or town can condemn property and acquire it through this process, upon paying the owner fair market value for the site, only Housing Agencies have the authority to condemn property for housing development. Cities and Towns are relegated to public uses that support infrastructure improvements (e.g., right of way acquisition, sewer and drainage improvements).

Locally, **Article XIII of the Town Charter** specifies the rules and procedures for acquisition of land through eminent domain and specifies that any land acquired through the eminent domain process must be used for a public purpose, which explicitly excludes,

"… the taking of private property solely to increase tax revenues to the town, or that such property or the benefit thereof may be transferred to private interests."

Disposition of Property

The State of North Carolina proscribes the methods for disposing of land in a fee simple transaction (sale of deed) or ground lease structure, where the Town maintains ownership of the land. These methods differ depending on which authority the Town uses to carry out the program. Following are the applicable legal statutes that dictate the process and use of such property transactions.

Most broadly, **Chapter 157 Housing authority law** exempts housing authorities, or local governments designated to act as housing authorities, from following disposition procedures required elsewhere in the General Statutes. Specifically, **§157-9 Powers of authority** states,

"In addition to all of the other powers herein conferred upon it, an authority may do all things necessary and convenient to carry out the powers expressly given in this Article. No provisions with respect to the acquisition, operation or disposition of property by other public bodies shall be applicable to an authority unless the legislature shall specifically so state."

Chapter 157 also allows for the development of mixed income housing, as long as 20 percent of units are set aside for low- and moderate-income households. **§157-3 Definitions** specifies that a housing project includes,

"...any project that provides housing for persons of other than low or moderate income, as long as at least twenty percent (20%) of the units in the project are set aside for the exclusive use of persons of low income."

Thus, projects under housing authorities law must contain at least 20 percent of units to be set aside for low- and moderate-income households. The duration of the restriction is 15 years by statute; however, if the developer does not pay market value for the land and the Town subsidizes the development, the units would need to be restricted in perpetuity as a community benefit in exchange for land value.

Housing authority law provides a wide berth for the acquisition, disposition, and development of affodable housing — including the use of eminent domain. However, it may also require the Town to perform responsibilities that it does not currently perform. The Town's Attorney should evaluate the Town's ability to designate itself as a housing authority and designate Wake County Housing Authority to continue in its current role providing housing services within Town limits.

If the Town opts not to designate itself as a housing authority, **§160A-265 Use and disposal of property**, states that at the discretion of the Board of Commissioners, the Town may,

"(i) hold, use, change the use thereof to other uses, or (ii) sell or dispose of real and personal property, without regard to the method or purpose of its acquisition or to its intended or actual governmental or other prior use,"

setting the stage for an affordable housing land disposition program.

The State of North Carolina does limit the means by which the Town can dispose of property, including land. Per **§160A-266 Methods of sale; limitation**, any real or personal Town-owned property can be disposed of through the following mechanisms:

- Private negotiation and sale (value under $30,000)
- Advertisement for sealed bids
- Negotiated office, advertisement, and upset bid
- Public auction
- Exchange

Under **§160A-266 Methods of sale; limitation**, properties with significant historical or cultural associations may only be sold to a nonprofit corporation or trust whose purposes include preservation or conservation of relevant properties.

These disposition mechanisms are required when municipalities dispose of their real personal property, including land for any use not otherwise specified within the State Code.

Under **§160A-272. Lease or rental of property**, the Town may lease any property to a developer for no longer than ten years. A ten-year lease would not be long enough to attract new development and would be hard for banks to finance. The state does allow for longer leases under **§160A-272 (b1),** which states that

"leases for terms of more than 10 years shall be treated as a sale of property and may be executed by following any of the procedures authorized for sale of real property"

under §160A-266 Methods of sale; limitation, with some exceptions for property leases for communications and other utility uses. Under these statutes, the process of disposition favors the highest bidder, which may not be appropriate for meeting the Town's affordable housing goals. **§160A-279 Sale of property to entities carrying out a public purpose; procedure**, does allow for disposition of land at a price below market value, but only to a non-profit developer.

The State of North Carolina does have another statute governing the sale or lease disposition of land for housing. **§160A-278: Lease of land for housing** states:

"A city may lease land upon such terms and conditions as it deems wise to any person, firm or corporation who will use the land to construct housing for the benefit of persons of low income, or moderate income, or low and moderate income. Such a housing project may also provide housing to persons of other than low or moderate income, as long as at least twenty percent (20%) of the units in the project are set aside for the exclusive use of persons of low income. Despite the provisions of G.S. 160A-272, a lease authorized pursuant to this section may be made by private negotiation and may extend for longer than 10 years. Property may be leased under this section only pursuant to a resolution of the council authorizing the execution of the lease adopted at a regular council meeting upon 10 days' public notice. Notice shall be given by publication describing the property to be leased, stating the value of the property, stating the proposed consideration for the lease, and stating the council's intention to authorize the lease."

This statute governs the leasing of Town-owned property for housing. It allows for leases of longer than ten years provided that at least 20 percent of units are set aside for low- and moderate-income households. Leases may be privately negotiated. Although, the Town must provide a public notice before The Board of Commissioners executes the lease, nothing in this statute precludes the Town from using a competitive developer solicitation process to select a preferred developer with whom the Town intends to negotiate the terms of the private negotiation.

§160D-1316: Low- and moderate-income housing programs is broader, allowing any local government to exercise the following powers:

"To convey property by private sale to any public or private entity that provides affordable housing to persons of low or moderate income under procedures and standards established by the local government. The local government shall include as part of any such conveyance covenants or conditions that assure the property will be developed by the entity for sale or lease to persons of low or moderate income".

To convey residential property by private sale to persons of low or moderate income, in accordance with procedures and standards established by the local government, with G.S. 160A-267, and with any terms and conditions that the governing board may determine."

This statute allows the Town to sell or lease the property for affordable housing development to low- or moderate-income households, or to sell homes directly to low- or moderate-income households — creating an exception to §160A-266 Methods of sale.

Properties acquired under **§160D-1312 Acquisition and disposition of property for redevelopment** may be disposed of per the provisions of Chapter 160A described above, or,

"to sell, exchange, or otherwise transfer real property or any interest therein in a community development project area to any redeveloper at private sale for residential, recreational, commercial, industrial, or other uses or for public use in accordance with the community development plan, after approval of the governing board and after a legislative hearing…"

This could be an approach for land located in the Northeast Community Plan Area.

Any properties condemned and acquired via eminent domain outside of housing authority law may be disposed of per **§40A-10 Sale or disposition of land condemned.** When any condemned property is no longer needed for its original purpose, it may be used for any other public purpose or may be sold or disposed of in the manner prescribed by law for the sale and disposition of surplus property. This may apply to formerly condemned Town-owned sites.

Locally, the Town Charter, Unified Development Ordinance (UDO), nor the Wake Forest Code of Ordinances comment on the Town's ability to or process for disposing of land.

Low and Moderate-Income Housing

As previously mentioned, Chapter 157 of the General Statutes relates to Housing Authorities and Projects. In this Chapter, the State defines "low- and moderate-income" as they relate to housing disposition requirements specified above. According to **§157-3: Definitions,**

"Persons of low income' means persons in households the annual income of which, adjusted for family size, is not more than sixty percent (60%) of the local area median family income as defined by the most recent figures published by the U.S. Department of Housing and Urban Development."

Further, §157-3: Definitions, defines,

"Persons of moderate-income [as] persons deemed by the authority to require the assistance made available pursuant to this Chapter on account of insufficient personal or family income taking into consideration, without limitation, (i) the amount of the total income of such persons and families available for housing needs, (ii) the size of the person's family, (iii) the cost and condition of housing facilities available, and (iv) the eligibility of such persons and families for federal housing assistance of any type predicated upon a moderate or low and moderate income basis."

In other words, moderate income household income limits are less defined under state statutes. However, some federal subsidies are available for households earning up to 80 percent of AMI.

The next chapter will provide more detailed income limits and fair market value rents for use in the program.

SECTION SUMMARY

- In North Carolina, a municipality can purchase and sell property without a specific purpose in mind.
- For property valued over $30,000, a municipality must solicit bids if they intend to sell said property.
- Normally, a municipality would need to award the sale of property to the highest bidder, but State statutes allow the Town to sell to the bidder most qualified in carrying out affordable housing development.
- A municipality can sell property for affordable housing at below market rate, but only if the purchaser is a non-profit.
- Procedurally, State law treats long-term leases (over ten years) the same as land sales.
- Land leased by a municipality to a developer for affordable housing must contain a minimum of 20 percent affordable units for low to-moderate income levels.
- Property sold or long-term leased to a developer for affordable housing must have covenants restricting its use.
- Municipalities can opt to designate themselves as a housing authority, which provides extra powers for the acquisition, disposition, and development of affordable housing, including the use of eminent domain.
- Becoming a housing authority could potentially involve a significant increase in roles and responsibilities for the Town.
- For affordable rental units, the State mandates they be affordable to incomes 60% or less of AMI.
- For ownership units, standard practice suggests they be affordable to incomes 80% or less of AMI.

SECTION III

Area Median Income (AMI) Limits

To establish an affordable housing land disposition program, it is necessary to evaluate and determine the appropriate Area Median Income (AMI) Income Limits schedule to use. Income limit schedules are produced by the U.S. Department of Housing and Urban Development (HUD). However, some cities and towns produce multiple schedules based on sources of funding. BAE reviewed the Raleigh, NC Metropolitan Statistical Area (Raleigh MSA) HUD Income Limits, discusses their use in a disposition program, the potential for affordable ownership housing as part of the program, and provides sources for updating relevant income data annually.

Income Limits

HUD releases several schedules of income limits for each county and metropolitan statistical area (MSA) annually. As the Town of Wake Forest falls within the Raleigh MSA, its income limits would be based on published income limits for that area. The income limit schedules calculate the family household area median income (AMI) for a family of four. From that, HUD calculates the maximum household incomes for families ranging between one and eight persons by income level.

HUD's income levels include extremely low-income (up to 30 percent AMI), very low-income (30.01 percent to 50 percent AMI), low-income (50.01 percent to 80 percent AMI), median income (80.01 percent to 100 percent AMI), and moderate income (100.01 percent to 150 percent AMI).

HUD sets the income limit schedule to determine which families qualify for Section 8 vouchers. However, income limits are also used to determine eligibility in other subsidized and unsubsidized affordable housing units, as well as for determining downpayment assistance eligibility, including as part of North Carolina's HOME downpayment assistance program. Table 1 shows the 2023 HUD income limits by household size and affordability for the Raleigh MSA.

Table 1: Raleigh MSA HUD Income Limit Schedule, FY 2023

	Persons per Household							
Income Limit Category	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Extremely Low (30% AMI)	$23,800	$27,200	$30,600	$34,000	$36,750	$40,280	$45,420	$50,560
Very Low (50% AMI)	$39,700	$45,350	$51,000	$56,650	$61,200	$65,750	$70,250	$74,800
Very Low (60% AMI)(a)	$47,640	$54,420	$61,200	$67,980	$73,440	$78,900	$84,300	$89,760
Low (80% AMI)	$63,500	$72,550	$81,600	$90,650	$97,950	$105,200	$112,450	$119,700
Median (100% AMI)(b)	$96,200	$96,100	$102,000	$113,300	$122,400	$131,450	$140,500	$149,600
Moderate (150% AMI)(b)	$119,000	$136,000	$153,000	$169,950	$183,550	$197,150	$210,750	$224,350

Median Family Household Income, FY 2023: $117,000 (c)

Notes:
(a) Sixty percent AMI limits are calculated for Low Income Housing Tax Credit (LIHTC) funded projects.
(b) HUD's Section 8 schedule does not include median- and moderate-income limits. HUD reports those separately as they are too high to qualify for the Section 8 voucher program.
(c) HUD's overall family household area median income may not match the 100 percent AMI for a four-person household due to internal adjustments in HUD's income limit calculations.

Sources: HUD; Wake County Housing Authority; BAE, 2023.

Source website links:

HUD income limits for households at 30, 50, and 80 percent AMI (Section 8 vouchers):
https://www.huduser.gov/portal/datasets/il.html

HUD Income limits for households at 60 percent AMI (Low Income Housing Tax Credit projects):
https://www.huduser.gov/portal/datasets/mtsp.html#2023_data

HUD income limits for households earning 100 percent and 150 percent AMI (Homeowner Assistance Fund):
https://www.huduser.gov/portal/datasets/haf-il.html

Affordable Rents

Affordable rents are set based on HUD's requirement for affordable housing projects using federal subsidies that no household pays more than 30 percent of its household income on housing expenditures. Dividing the maximum household incomes per affordability category provided in the income limit schedule by 12 months to get a monthly income, and then multiplying by 30 percent gives the maximum affordable rent that a household can pay:

- (Annual household income)/12 = Monthly household income
- Monthly household income * 30% = Maximum monthly rental housing payment

However, rents are typically based on the number of bedrooms[1] rather than number of tenants. Industry practice estimates that the number of persons per household equals the number of bedrooms plus one. Under this scenario, a couple could share a studio unit, or a single parent and two children could share a two-bedroom apartment. Additional persons would lead to overcrowding, which HUD does not allow. Accordingly, when determining which income limit household sizes correspond to apartment sizes the following applies:

- Number of bedrooms + 1 = Persons per household, or
- Persons per household – 1 = Number of bedrooms

In addition to converting household sizes into bedroom counts, HUD requires the maximum monthly payment towards rental housing to include utility allowances. As Table 2 shows, the average Raleigh MSA estimated utility allowances by unit size in 2023 are as follows:

Table 2: Raleigh MSA Average Utility Allowances, FY 2023

	Bedrooms per Unit (a)				
Raleigh MSA	**0**	**1**	**2**	**3**	**4**
Estimated Utility Allowance	$159	$176	$227	$281	$334

Sources: Raleigh Housing Authority; BAE, 2023.

The utility allowances do not change by affordability level, but can change based on the types of utilities within the development (e.g., gas, electric) and anything otherwise included in the monthly rent. The Raleigh Housing Authority provides two allowance schedules appended to this memorandum. Subtracting the utility allowance from the maximum monthly payment provides the maximum affordable rent that an apartment can charge its tenants.

Maximum monthly payment – Utility allowance = maximum affordable rent

[1] Within a single hypothetical project at the same location and with the same amenities.

Table 3 shows the maximum affordable Raleigh MSA rents, net of utilities.

Table 3: Raleigh MSA Affordable Monthly Rents, FY 2023

	Bedrooms per Unit				
Income Limit Category	**0**	**1**	**2**	**3**	**4**
Extremely Low (30% AMI)	$436	$504	$538	$569	$585
Very Low (50% AMI)	$834	$958	$1,048	$1,135	$1,196
Very Low (60% AMI)(a)	$1,032	$1,185	$1,303	$1,419	$1,502
Low (80% AMI)	$1,429	$1,638	$1,813	$1,985	$2,115
Median (100% AMI)	$2,246	$2,229	$2,323	$2,552	$2,726
Moderate (150% AMI)	$2,816	$3,224	$3,598	$3,968	$4,255
Utility Allowance	*$159*	*$176*	*$227*	*$281*	*$334*
Median Wake Forest Market Rate Rents, May 2023	N/A	$1,342	$1,636	$1,846	$2,130

Notes:
(a) Schedule assumes household size = number of bedrooms plus one. Maximum housing payment is based on 30 percent of monthly household income less utility allowance. Utility allowance based on Raleigh Housing Authority estimates.
(b) There are no available studio units in Wake Forest to provide an average rent.

Sources: Raleigh Housing Authority; CoStar; BAE, 2023.

Source website links: Raleigh Housing Authority utility allowance forms and estimates:
https://www.rhaonline.com/section-8-landlords/

As Table 3 shows, affordable rents are lower to households earning 60 percent AMI or less, while market rents are lower than the maximum rents affordable to low-, median-, or moderate-income households. In those cases, households can rent units on the open market and do not need access to subsidized housing.[2] However, deed restrictions on these units can protect against future rent increases.

[2]An income group's ability to pay market rate rents and prices can vary by area and over time.

Affordable Sales Prices

Similar to rents, affordable home prices also require that households pay no more than 30 percent of their monthly incomes on housing, including mortgage principal and interest, insurance, taxes, and other expenses that are generally paid through mortgage escrow accounts.

While developers can build an affordable ownership unit, the homebuyer must be able to qualify for a mortgage. In fact, the primary source of affordable ownership unit subsidization comes from downpayment assistance programs, whether federal (FHA, VA) or state run. The State of North Carolina offers several low-cost loan and downpayment assistance programs. Its Community Home Buying Programs offer downpayment assistance for borrowers that have household incomes up to 80 percent AMI. Table 4 shows maximum sales price for units eligible under the State's Community Home Buying Programs.

Table 4: Maximum Sale Price for State Affordable Homeownership Programs, 2022

AMI Level	Existing Property	New Construction (a)
Franklin County	$280,000	$280,000
Wake County	$309,000	$309,000

Median Wake Forest Home Sale Price, All units, May 2023: $503,200

Notes:
(a) The State Community Home Buying Programs differentiates prices between existing properties and new construction in other locations.

Sources: State of North Carolina Housing Finance Department; BAE, 2023.

While the State has a maximum sales price independent of home size, it is possible to calculate maximum sales prices for households earning between 80 and 120 percent AMI, per bedroom count. As Table 5 shows, the maximum sales price for the State programs in Wake County ($309,000) exceeds the maximum sales price a low-income household could afford to pay, with housing costs not exceeding 30 percent of household income. The maximum sales price for state programs in Franklin County ($280,000) is attainable to Low-Income households of three or more persons, as well as households earning 100 percent or more of AMI.

Table 5: Raleigh MSA Affordable Sales Prices, FY 2023

	Bedrooms per Unit				
Income Limit Category	**0**	**1**	**2**	**3**	**4**
Low (80% AMI)	N/A	$224,163	$252,126	$280,088	$302,643
Median (100% AMI)	N/A	$297,136	$315,157	$350,071	$378,188
Moderate (120% AMI)	N/A	$420,209	$472,735	$525,107	$567,128

Median Wake Forest Home Sale Price, All Units, May 2023: $503,200

Sources: Zillow; BAE, 2023.

Source website links: Wake and Franklin Counties Maximum State Affordable Home Price (source page; click on household income limits or sales price limits): https://www.nchfa.com/home-buyers

SECTION SUMMARY

- The US Department of Housing and Urban Development (HUD) publishes local Area Median Income (AMI) limits annually.
- As indicated in the previous section, a 60 percent AMI income limit should be used for rental units and an 80 percent income limit should be used for homeownership.
- Per HUD guidelines, for a home to be affordable, a household should not spend more than 30 percent of their income on housing costs.
- While Wake Forest rents exceed what lower income households (60 percent AMI and below) can afford, the affordability gap for homeownership is even more pronounced, even at 80 percent AMI.

SECTION IV

Peer Cities Review

The project scope includes a review of efforts similar to the land disposition program the Town of Wake Forest seeks to create. BAE conducted interviews with staff from cities, towns, and Wake County, as well as affiliate housing agencies and nonprofits to gain a better understanding of how land disposition programs can work. The peer cities and other affiliate organizations, all located in the Triangle Region, were able to provide information on approaches and lessons learned operating similar programs within the same regulatory environment.

Town of Apex

As with Wake Forest, a land disposition program was recommended as part of Apex's Affordable Housing Plan that was adopted in 2021. The Town recently developed an Affordable Housing Incentive Zoning Policy that could be instructive to the Town of Wake Forest. Key points around that effort are described below.

With input from the private sector development community, the Town of Apex staff developed an Affordable Housing Incentive Zoning Policy. (See Appendix A.). Since including affordable housing in development plans is voluntary, incentives for developers to include it in their plans are necessary.

The zoning incentive policy includes "zoning-based, non-financial and financial incentives" that can be provided by the Town in exchange for providing residential affordable housing units or lots on-site within a development through the rezoning or Planned Unit Development (PUD) process. Apex's Town Council voted to adopt the Policy on June 27, 2023.

Town staff indicate that while they had been using the draft policy as a guide in negotiations with Rezoning and Planned Unit Development applicants, the plan is to officially "road-test" the Policy for one year from adoption date, and revisit any of the applicability standards or available incentives as needed.

Zoning-based incentives that a developer may request include the ability to apply for a zoning district that allows more housing types and density, a density bonus, an adjustment to development standards, increased building maximum (i.e., increased maximum building height, reduced building setbacks, and reduced minimum lot widths), reduced Resource Conservation Area requirements, parking reductions, and sidewalk reductions.

A non-financial incentive that could be provided is expedited processing of site plan and master subdivisions plan applications when at least 10 percent of the residential units or lots are set aside for affordable housing.

The Town may provide a financial incentive in the form of a grant for reimbursement of certain development fees to help offset some of the development costs for providing affordable housing units or lots within a development. The Policy requires that funds must be structured to reduce the housing cost for the end user in the form of a lower purchase price or monthly rental cost.

Finally, the Town may choose to provide financial assistance in the form of a loan or grant within a development to assist with the creation of affordable housing units or lots.

Interview contact: Michael Linsenmeyer, Senior Housing Specialist, Town of Apex, NC.

City of Raleigh

Raleigh's current efforts with land disposition for affordable housing are a shared responsibility between the Housing and Neighborhoods Department and a part of the Raleigh Planning Department called Urban Projects. Housing and Neighborhoods identifies the focus sites where they believe new affordable housing development is needed and appropriate and Urban Projects does the site analysis.

When contacted, City staff discussed two land disposition projects: Lane-Idlewild and Duplex Village. Lane-Idlewild, is a 1.17 acre City-owned site located at the intersection of Lane Street and Idlewild Avenue in the West Idlewild neighborhood on the eastern edge of downtown Raleigh. In 2021, after a two-step solicitation process including a Request for Interest (RFI) and a Request for Proposal (RFP), the Raleigh Area Land Trust (RALT) was selected by the City to develop the Lane-Idlewild site into affordable housing. RALT is working on the proposed 18-unit affordable low-income cottage court development utilizing a Community Land Trust (CLT) model with the goal of establishing permanent affordability (i.e., 99 years). Of the 18 affordable units, 14 units will be for-sale (50 to 60 percent AMI) and four units will be rentals (30 to 80 percent AMI).

RALT recently received approval of their Administrative Site Review (ASR) application and is moving forward with the next stage of the development process and will submit for Site Permit Review (SPR). As of this writing, RALT is working on completing due diligence items including securing financial commitments. RALT's goal is to receive site control of the development site from the City and start construction in 2024.

The layout of the units will be in two U shapes, with a common area in the middle to "build community." It is important to note that the City recently approved zoning text changes which make the Cottages at Idlewild project possible. According to City staff, without those changes to the zoning code, the project could not have as many units.

Another significant project for Raleigh began with the City's purchase of a portion of Duplex Village, an older (1949) rental community located along the future bus-rapid transit route planned for new Bern Avenue in Raleigh. In 2021, the City purchased about four acres of the 9.46-acre low density rental development for $3.7 million, using funds from City's $80 million affordable housing bond that voters approved in 2020. Buying land along transit corridors to expand affordable housing opportunities is one of the goals of the bond initiative.

The portion of Duplex Village that was purchased included 24 rental units, about half of which were vacant at that time. In the past two years, the City worked with the remaining tenants to transition them into other housing options and began demolition of the units. City staff indicate an RFP will be issued to for-profit and nonprofit developers in August 2023 for a mixed-use development, to include housing for low to moderate income households and retail.

The City of Raleigh also began a pilot Small-Scale Rental Development program that combines funds from the 2020 Affordable Housing Bond and City-owned lots in downtown Raleigh. According to the City's website, the Small-Scale Rental pilot was created to "build on the text changes to the Unified Development Ordinance (UDO) that allow 'missing middle' housing to be built on lots zoned for single-family residential in order to create rental options that are affordable to low-income households." The Small-Scale Rental Development program is open to nonprofit affordable housing developers and for-profit developers working in partnership with a mission-driven nonprofit. The City has had two funding rounds for this pilot program since it was initiated in 2021.

Interview Contacts: Erika Brandt, Housing Programs Administrator, Housing and Neighborhoods Department, City of Raleigh, NC; and Lamont Taylor, Assistant Director, Housing and Neighborhoods Department.

Wake County

In 2019, Wake County implemented a policy that establishes procedures and standards for the evaluation and disposition of available County-owned properties and other publicly owned properties for the development of affordable housing. This policy, which was enacted to comply with N.C.G.S. 160D-1316, was most recently updated in 2021.

The policy, included in Appendix B, entitled "Evaluation and Disposition of County-owned Land for Affordable Housing," includes a policy statement which indicates that before "disposing of County-owned properties, Wake County shall evaluate County-owned properties for affordable housing use, including physical feasibility, suitability, necessity, and alignment with County policy priorities regarding affordable housing development." Perhaps most important for Wake Forest and other municipalities in Wake County, the County's land disposition policy sets criteria for the evaluation and disposition of County-owned land and other publicly owned property for affordable housing.

This last point is key since Wake County does not have much excess land nor has it been acquiring land, but County leaders recognize that some municipalities in the County do own a lot of land. And in fact, most of the property evaluated for future affordable housing under the criteria included in this policy since it was established in 2019, has been municipal-owned.

The criteria for multifamily land disposition site conditions for determining physical feasibility include ownership status (i.e., County, County Board of Education or Municipal), lot size, built area, floodplain status, topography, utility connections, and access. Site suitability criteria include status of encumbrances, proximity to existing residential and commercial, connectivity (i.e., transit access, sidewalks), zoning, proximity to basic services (i.e., grocery store, pharmacy, etc.), Low Income Housing Tax Credit (LIHTC) eligibility, and market strength.

Properties that are both physically feasible and suitable for multifamily affordable housing may be recommended by the Housing Affordability & Community Revitalization Department for disposition through private sale. If recommended for disposition, a competitive RFP process is used to dispose of the properties under this policy. The County requires detailed financial projections of the proposed development. The County then reviews each project's financial projections to evaluate the level of discount to land price necessary and will consider which proposal maximizes public benefit.

If the publicly owned property is less than one-acre in size, it will be assessed for single family, affordable housing development or preservation. Should development or acquisition be feasible for affordable housing, the property is recommended for private sale.

The Wake County Housing Department maintains a list-serve of single-family affordable housing developers, investors, partners, and other interested parties. If a property is deemed eligible for single family disposition, a notification will be sent to the list-serve and published on the website. The Housing Department will receive offers to purchase by a date designated in the list-serve email. Staff will review the offers to purchase by analyzing/reviewing property features (i.e., fair market value, assessed tax value, etc.), applicant information including financial projections or income information, and legal sufficiency. As with the multifamily proposals, County staff will evaluate the level of discount necessary to maintain affordability and consider which offer maximizes public benefits according to the requirements of the policy.

Additionally, it is important to note that under Wake County's land disposition policy, the County's priority is realizing the deepest level of affordability possible, including:

- Rental units affordable at or below 30-40 percent AMI;
- If rental units can not be provided at the 30-40 percent AMI level, the County will accept rental units at the 40-50 percent AMI range;
- For sale units affordable to populations at or below 80 percent AMI.

When contacted for more information about the County's land disposition policy, staff discussed several land disposition opportunities that went as far as an RFP process. One example of such a project is the disposition of County-owned land at 1317 N. Main Street Holly Springs, NC. Wake County issued an RFP in January 2020 for a development team to purchase and develop a vacant property at 1317 N. Main Street in Holly Springs.

The County specifically asked for proposals from for-profit and nonprofit developers to construct a mixed-income, mixed use project that is walkable and environmentally sustainable.

DHIC, a nonprofit affordable housing developer, and MyComputerCareer Inc., an adult technical school came together to submit a proposal for the site that included 125 affordable housing units and an 80,000 square foot, a four-story office building to be occupied by MyComputerCareer, 10,000 square feet of retail space, and a "state-of-the-art performing arts theatre." Though the DHIC team was awarded the development, the commercial component has changed. Instead of MyComputerCareer Inc., which is no longer in the deal, Capital Associates, a full-service commercial real estate company involved in the project, has reoriented the commercial component of the Holly Springs site. It will include office, hotel, and retail.

Another RFP for affordable housing development was also issued by Wake County for land located on Chapanoke Road in Raleigh adjacent to the Wake Technical Community College. That RFP, issued in 2022, was sent to for-profit and nonprofit developers for proposals "to construct a walkable, environmentally sustainable, affordable, mixed-income multi-family project that fits within the context to the Southern Wake Bus Rapid Transit (BRT) Corridor." Wake Tech transferred the property, which was originally intended for campus facilities, to Wake County to provide affordable housing options for the community and Wake Tech students. Per Wake County staff, 30 percent of the affordable units are to be set aside for Wake Tech students.

Interview Contacts: Alicia Arnold, Deputy Housing Director, Department of Housing Affordability & Community Revitalization Wake County, NC; and Mark Perlman, Division Director-Equitable Housing and Community Development, Department of Housing Affordability & Community Revitalization Wake County, NC

Raleigh Area Land Trust

The mission of the Raleigh Area Land Trust (RALT) is to create permanent affordable homeownership opportunities for first-time homebuyers using the Community Land Trust model. According to RALT's website, the Community Land Trust model is built to serve as a "long-term steward of land to protect long-term affordability and access to housing." Working under this model RALT acquires land to build homes or rehabilitates existing homes and makes the new or rehabilitated homes available for sale to limited-income homebuyers at 60-80 percent of AMI, with subsidies lowering the price.

As described above in the City of Raleigh section of this memorandum, RALT was selected to be the developer of affordable housing on the City-owned Lane-Idlewild site in Raleigh. After RALT was selected by the City through a competitive RFI/RFP process, the City agreed to sell the 1.17 acre site to RALT for $1.00. RALT will develop 18 affordable homes on the site, which will be called the Cottages at Idlewild. Of the 18 affordable units, 14 units will be for-sale (50 to 60 percent AMI) and four units will be rentals (30 to 80 percent AMI). RALT recently received approval of their ASR application and is moving forward with the next stage of the development process and will submit for SPR. As of this writing, RALT is working on completing due diligence items including securing financial commitments. RALT's goal is to receive site control of the development site from the City and start construction in 2024.

RALT also purchases and rehabilitates individual affordable homes for income-eligible first time buyers. In June 2023 RALT sold its first affordable home to a first-time homebuyer. The home, located in southeast Raleigh, is a remodeled three-bedroom, one bathroom single-family house. The homebuyer was able to purchase the home at an affordable price, thanks to funding support and subsidies from the City of Raleigh and individual donors. Indeed, the City of Raleigh provided a 0% interest, deferred payment loan to RALT for $130,000. That loan provided seed funding for the purchase and rehabilitation of two homes, which were updated to be sold to eligible low-income homebuyers.

Rhett Fussell, who is serving as the Interim Director of the Land Trust expressed a strong interest in working with Wake Forest once it creates a land disposition program. They have discussed doing projects similar to the two types of affordable housing projects described above with both the Town of Apex and the Town of Cary. When asked what would be helpful to RALT for Wake Forest to consider as it develops its land disposition program, he offers a few recommendations. These are provided below:

- For the land disposition, make it flexible but focused on nonprofits.
- Not requiring all of the units' buyers to be less than 80 percent of AMI would help RALT get financing. RALT can sell up to 25 percent at market rate and keep nonprofit status and the market rate units will subsidize the 80 percent units.
- If possible, the municipality should award the land/property to the nonprofit immediately with a stipulation that "construction or financing must be in place by 6 months." Without this site control, the financing becomes "chicken and egg."
- Recognizing that the community land trust model is a good way for families to build wealth, the Town could leverage their assets and provide for their employees by building in stipulations that, for example, "25 percent of the homes are allocated for town staff/fire/police that meet the AMI categories.
- RALT needs other partners in Wake County to help show "proof of concept." Wake Forest could help with this, even if it is a single family lot on which they could build a duplex.
- Suggestion that instead of issuing RFPs each time an affordable housing opportunity arises, municipalities should create a bench of pre-qualified developers who could submit proposals to lead the development of a given property. RALT thinks that municipalities do not appreciate how difficult it is to respond to an RFP, particularly for nonprofit developers.

Interview Contact: Rhett Fussell, Interim Director, Raleigh, NC Raleigh Area Land Trust.

DHIC

DHIC is a nonprofit founded nearly 50 years ago that owns, manages, and develops affordable housing in the Triangle Area of North Carolina. According to their website DHIC also helps first-time buyers develop and implement a homeownership plan tailored to their individual needs and circumstances. DHIC is a HUD-certified counseling agency.

Yolanda Winstead, DHIC's President and CEO expresses strong interest in working with the Town of Wake Forest to help create and preserve affordable housing. She also notes that DHIC has owned and operated an affordable housing development in Wake Forest, Turnberry Apartments, for the past 20 plus years.

DHIC has been involved in several affordable housing developments with the various municipalities in the Triangle Area that are located on publicly owned land including:

- Willard Street Apartments – DHIC was the lead developer of this recent infill apartment building located on a 1.25-acre piece of land owned by the City of Durham, adjacent to the Durham Station Transportation Center. The 82 affordable apartment homes for households with 30 percent and 60 percent of AMI, are located on four floors above two floors of structured parking. There is also 5,000 square feet of ground floor retail space, and a plaza overlooking the city skyline. The City of Durham donated the land for the development and provided a low-interest loan to assist with financing. Duke University and the A.J. Fletcher Foundation also provided another $5.5 million in grants for the development.
- Greenfield Community – DHIC developed and manages Greenfield Place and Greenfield Commons which together make up the Greenfield Community in Chapel Hill. The Greenfield Community includes 149 apartment homes for seniors and working families. This development serves households with incomes at or below 60 percent of AMI. The Town of Chapel Hill donated the land for the Greenfield Community.
- Jeffrey's Ridge – A 32-unit apartment community in southeast Raleigh. The City of Raleigh owns the land. DHIC owns and manages the apartments.
- Holly Springs Development – The aforementioned planned development in Holly Springs, in conjunction with Wake County. The development will include 124 units of affordable housing on County-owned land as well as a commercial use to be determined.

Ms. Winstead noted that municipal contributions toward the development of affordable housing in the Triangle area have been extremely helpful in getting these projects built. Given current economic conditions and the increasing cost of construction, county, city and town involvement in the financing of these projects has become more important than ever. She applauds the City of Raleigh and City of Durham bond referendums of $80 and $95 million respectively for affordable housing. The contribution of land by towns and cities has been critical as well. She also believes the Triangle municipalities need to work together to get the State of North Carolina to provide more assistance on financing affordable housing development, in-line with what other state housing finance agencies do to preserve and create more affordable housing.

Interview Contact: Yolanda Winstead, President and CEO, DHIC Raleigh, NC

Wake County Housing Authority

Wake County Housing Authority (WCHA) owns and manages 345 public housing units, 10 affordable housing units, and 585 Housing Choice vouchers throughout Wake County. Of the 345 public housing units, 144 are located in the Town of Wake Forest on three different properties.

Dawn Fagan, WCHA's Executive Director expressed strong interest in a partnership with the Town of Wake Forest to improve or redevelop the three properties and create new affordable units wherever possible. She believes there is potential to do this because there is a significant amount of unused land surrounding the three properties. She stresses, however, that identifying resources for this type of effort is always challenging.

HUD is encouraging public housing authorities to use the Rental Assistance Demonstration program, commonly referred to as RAD, which allows housing authorities to leverage public and private debt and equity in order to reinvest in the public housing stock. Ms. Fagan also spoke to the Town about applying for a Choice Neighborhoods grant for redeveloping and potentially adding affordable units on their properties. Her hesitation on seeking Choice Neighborhoods grants, which leverage significant public and private dollars to support locally driven strategies that address struggling neighborhoods through a comprehensive approach to neighborhood transformation, is that the Town must be fully on board with the broader neighborhood transformation goal to have a competitive application to HUD.

Ms. Fagan indicates that the Town has expressed interest in WCHA's White Street property for adding affordable units, along with redevelopment but she sees the North Allen Street property (Massey Apartments) as the one that most acutely needs redevelopment. She reports that WCHA has struggled the most with the North Allen Street property including issues with plumbing and sewer lines that forced six families to temporarily relocate. She would like to see a major redevelopment of the property, using tax credits and mixed financing. Since the property is 7.63 acres there is room to add affordable units there.

When asked if WCHA would be willing to accept a transfer, for a nominal amount, of publicly owned property for that property to be developed into affordable housing, Ms. Fagan indicated she would as long as the plans for the property are agreed to by all interested parties. She did not realize that under North Carolina law housing authorities could exercise eminent domain for the purpose of creating affordable housing, a public benefit. She says the WCHA recognizes there is a shortage of affordable housing in Wake County, including in Wake Forest, and would be willing to work in partnership with the Town to help to resolve that deficiency.

Interview Contact: Dawn Fagan, Executive Director, Wake County Housing Authority, Zebulon, NC

Housing Market Contacts

BAE contacted two other individuals on the Town's list of suggested stakeholder interviewees: Dustin Engelken, Government Affairs Director for the Triangle Apartment Association, and Jacob Anderson, owner of Alliance Group NC LLC, a real estate brokerage and consulting firm specializing in land acquisition for both residential and commercial opportunities. These two individuals are knowledgeable about demand for affordable housing and market demand for housing in general.

Triangle Apartment Association

Interviewee Dustin Engelken describes the Triangle Apartment Association as a membership organization for owners, operators, developers and other businesses associated with multifamily properties in the Triangle area. The Triangle Association's members manage 165,000 apartment units in the broader Triangle area with 100,000 of those in Wake County.

Mr. Engelken served on the Wake County Affordable Housing Working Group and is knowledgeable about the current housing market in the region, both market rate and affordable.

Mr. Engelken reports that the current apartment demand is strong in the Triangle area. Because the region continues to grow economically—new businesses have located in the area and existing businesses are expanding—demand for apartments, whether affordable, workforce, or market rate is high. He reports that rent growth and occupancy are strong on the market rate side. Rents are also up somewhat on the affordable and workforce side at least in part because of increased operating and maintenance expenses.

Developers in the multifamily space are reporting that it has become increasingly difficult to finance multifamily housing. The interest rates and construction costs are making it difficult for apartment developers to make an acceptable rate of return. Mr. Engelken anticipates that unless the interest rates and costs ease, there will be a shortage of apartments in the next few years.

Mr. Engelken also stressed that affordable rentals are especially hard to finance now. Everyone involved in affordable housing finance is being cautious. Also, unlike other states, North Carolina's Housing Finance Agency offers little in the way of tools and resources for affordable housing. Mr. Engelken asserts that North Carolina's housing finance agency's focus is primarily on housing tax credits, not financing.

On the local front, Mr. Engelken believes RFPs for affordable development have become too prescriptive. In an effort to please everyone, the RFPs have become so onerous and overzealous that they will attract few bids from developers. He believes the RFPs need to be more accessible for local groups and nonprofits.

Alliance Group NC LLC

Jacob Anderson, owner of Alliance Group NC LLC provided input of the overall housing market. His company acquires land and buildings for housing and is also a real estate brokerage. Accordingly, Mr. Anderson has strong opinions on aspects of the housing market, both market rate and affordable. Some of his feedback is outlined below:

- If Wake Forest decides to put forward zoning incentives for affordable housing, those should focus on expedited review to save time and density. These are the two incentives that will make the biggest difference.
- Has a general concern about concentrating affordable housing in the same specific areas in towns and cities. This concentrates poverty which is not good for anyone.
- Along those lines, Habitat for Humanity houses seem to be clustered in the same areas.
- Admires the approach of the Town of Davidson NC toward affordable housing. The town requires housing proposals to include 10 percent affordable housing and this policy has broad resident support.
- Every town and city should have a trusted group of advisors who understand finance and review development proposals before they go to the Planning Board. The Town of Apex does this with their Environmental Advisory Board. They conduct rezoning preapplication reviews. This board offers a general list of suggested rezoning conditions for rezoning applicants to consider before filling a rezoning petition.

SECTION SUMMARY

- The Town of Apex adopted a zoning incentive policy for affordable housing in June 2023.
- The Town of Wake Forest could monitor how the zoning incentive policy works for the Town Of Apex as staff "road-tests" the new policy over the next year.
- The City of Raleigh approved zoning text changes to accommodate more "missing middle" housing, allowing more density on what had been single family lots. This makes it possible for the planned Cottages at Idlewild to have as many as 18 units on a 1.17-acre site.
- The City of Raleigh's $80 million affordable housing bond approved by the voters in 2020 has provided financial assistance for several affordable housing developments. One example is the purchase of a portion of Duplex Village, an older rental community, for a mixed-use development that will include housing for low-moderate income households and retail.
- Wake County has developed a land disposition policy for affordable housing that applies to County-owned land as well as other publicly owned land in the County.
- The City of Raleigh selected the Raleigh Area Land Trust (RALT) to develop a 1.17-acre site at Lane and Idlewild streets in Raleigh for 18 affordable homes in development called the Cottages at Idlewild. Most of the homes (14) will be for-sale units, the remainder will be rentals.
- In the last month (June 2023) RALT sold its first home, located in Raleigh, to a first time homebuyer. The City of Raleigh provided RALT with a $130,000, 0% deferred payment loan to rehabilitate two homes to be sold to low-income buyers. This home is the first of the two.
- RALT is eager to build for-sale housing in Wake Forest. Such a project could jumpstart the land disposition program in Wake Forest and show more proof of concept for the community land trust model.
- DHIC, a non-profit affordable housing developer, has been involved in several affordable rental housing developments that are located on publicly owned land including:
  1. Willard Street Apartments – 82 affordable apartments on an infill site located on a city-owned site in Durham NC, adjacent to the Durham Station Transportation Center.
  2. Greenfield Place and Greenfield Commons - 149 total family and senior affordable apartments on city donated land in Chapel Hill NC.
  3. Jeffrey's Ridge – 32-unit apartment community in southeast Raleigh located on city-owned land.
  4. Holly Springs – 124 units of affordable housing with commercial use on Wake County-owned land.
- Raleigh's $80 million affordable housing bond and the City of Durham's $95 million housing bond have been extremely helpful for financing new affordable housing.
- There may be opportunities to add new affordable housing units in Wake Forest on land owned by the Wake County Housing Authority.

SECTION V

Best Practices and Recommendations

The recommendations included in this report take into consideration the unique characteristics of the Town of Wake Forest and local and North Carolina laws. They also reflect documented best practices in other local jurisdictions (i.e., cities and counties) across the United States as well as in other North Carolina municipalities subject to the same regulations as Wake Forest. Other land disposition programs researched for this effort include those in place in the following cities and counties:

- Charlotte, NC
- Montgomery County, MD
- Philadelphia, PA
- Saint Paul, MN
- Seattle, WA
- Tacoma, WA
- Washington, DC

BAE also reviewed topical reports on land disposition for affordable housing that were produced by the National Housing Conference, the Urban Land Institute, the Northern Virginia Affordable Housing Alliance, and other organizations. Finally, BAE considered the information gathered from Triangle peer towns and cities and Wake County collected during interviews.

Accordingly, below are recommendations reflective of the needs and requirements of the Town of Wake Forest, local and North Carolina law and regulations, and policies and practices used in other places with active land disposition programs. With each recommendation, as appropriate, we briefly discuss strategies to accomplish the action, the reasoning behind the action, and provide an estimate of appropriate timing for the activity. The timing is either **immediate**, within nine months; **short-term**, nine to eighteen months; or **medium-term**, eighteen months to three years.

Acquisition and Disposition Criteria

Acquisition recommendations reflect best practices for acquiring future affordable housing sites, focusing on selecting sites based on proximity to schools, transit, and fresh food sources, as well as putting processes in place to allow Town staff flexibility to acquire sites in a timely manner. Disposition recommendations focus on processes and partnerships for maximizing successful outcomes (i.e., affordable housing development).

1. Establish criteria for potential affordable housing sites. The Town and BAE created the following scorecard for site evaluation:

WAKE FOREST SITE SUITABILITY SCORE CARD			
Instructions: Property will be scored using the scoring criteria outlined below, with 1 being low and 5 being high (see scale for details). Fill in the colored cell that corresponds to the scoring criteria below. Return this form to bwest@wakeforestnc.gov, no later than EOB on Monday, January 1, 2024.			
Site Location:		**101 & 102 Affordability Way**	
CATEGORY	*WEIGHT*	*RAW*	***FINAL***
Environmental Considerations	**40%**	**5**	**2**
Extent to which the site contains few, if any streams and wetlands	25%	5	
Extent to which the site contains few, if any steep slopes *(> than 20% slope)*	25%	5	
Extent to which the site is outside of a floodplain area	25%	5	
Extent to which the site is uncontaminated with hazardous chemicals or material *(may require Phase I Assessment)*	25%	5	
	100%		
Site Features	**40%**	**5**	**2**
Site access to major roads or highways *(straight line distance)*	15%	5	
Site proximity to transit *(straight line distance)*	15%	5	
Site proximity to a grocery store *(straight line distance)*	15%	5	
Site proximity to a school *(straight line distance)*	15%	5	
Extent of existing water and sewer infrastructure in place at site	20%	5	
Extent to which there is a need for demolition of existing structures and improvements *(1 = significant need)*	5%	5	
Extent to which historic resources may be disturbed (1 = significant disturbance)	15%	5	
	100%		
Process Considerations	**20%**	**5**	**1**
Current zoning allows for a variety of housing types/products	20%	5	
Site has clear ownership title with no encumbrances *(includes liens and covenants)*	30%	5	
Site price in relative alignment with market rate or appraised value	50%	5	
	100%		
TOTAL			**5**
		Comments:	Detailed aerial imagery with acreage and PINs found in Attachment A

Scale
5: Property meets all desired criteria
4: Property meets most desired criteria
3: Property meets some desired criteria
2: Property meets only a few desired criteria
1: Property does not meet any desired criteria

These criteria should apply to publicly owned sites to create a site ranking for disposition, and to privately-owned sites that could reasonably be acquired.

Timing: Immediate

2. Maintain a database of suitable sites.

Having an internal inventory of parcels suitable for affordable housing projects will help prioritize future land disposition and acquisition opportunities.

Timing: Short-term

Site Acquisition

Because the Town is not a Housing Authority itself, site acquisition strategies and best practices should focus on creating funding sources for acquisition, identifying potential sites, and partnering with a local Housing Authority.

1. Establish partnerships with other entities that have legal authority to develop affordable housing on public land.

To maximize the opportunity to create more affordable housing, the Town should partner with an entity that has the authority to plan for and lead the development of affordable housing. Under North Carolina law housing authorities, such as the Wake County Housing Authority (WCHA) can exercise eminent domain for the purpose of creating affordable housing, as a public benefit. This would require the entity to accept a transfer, for a nominal amount, of the publicly owned property to be developed into affordable housing.

Timing: Short-medium-term, project by project

2. Expand affordable housing fund to help purchase housing sites.

Even sites acquired through eminent domain must pay property owners the fair market value for their sites. The Town can assist with the purchase of affordable housing property by developing an affordable housing fund. Within this fund, the Town can approve an annual budget for property acquisition in order to minimize delays when a site becomes available.

Several jurisdictions in the Triangle Region have affordable housing bond funds that have provided critical financial assistance for affordable housing developments including the City of Raleigh ($80 million) and the City of Durham ($95 million). These funds can be used in the purchase of land and/or the construction of housing units.

Timing: medium-term, to the extent possible as a bond fund would require voter approval

3. Identify underutilized sites. Conduct an analysis of underutilized sites in key locations to determine whether any owners might be willing to sell unlisted sites.

This may be a preferred manner for acquiring sites in order to avoid competing with private buyers. However, it will require additional strategies to keep sellers from inflating prices above market rates.

Timing: Short-term

4. Expand relationships with brokers to assist with identifying listed sites.

Continue and/or form relationships with local real estate brokers to assist in acquiring sites listed for sale. This could include the following:

- Securing a bench of brokers to represent the Town in a transaction.
- Asking brokers to proactively find sites.
- Allowing the broker to contact property owners.
- Allowing brokers to negotiate on the Town's behalf.

Timing: Short-term

5. Continue and expand subscriptions to listing services.

CoStar, MLS, and other online tools provide alerts when sites that meet criteria become available for sale. Town staff can actively watch for sites that become available.

Timing: Short-term

Site Disposition

Site disposition strategies focus on prioritization of potential disposition sites and approach to the disposition process.

1. Identify Town-owned properties that have potential to be developed with affordable housing.

To the extent possible these sites should be in accessible, high-value areas to avoid concentration of affordable housing in any one neighborhood. This process should proceed as follows:

Step 1: Determine that site is surplus to the needs of the Town and its departments.

Step 2: Analyze whether the site fits with established criteria.

Step 3: If the site fits with criteria established, the potential opportunity should then be put in the development queue.

Step 4: If the site does not meet the criteria above, determine if it has potential value to trade in return for other properties that could be used for affordable housing.

Timing: Immediate, after criteria are established

2. Prioritize the disposition sites that meet established criteria

In addition to the criteria listed for site acquisition, the criteria for disposition should also favor sites that are:

- Owned by the Town (as opposed to other public entities).
- Sufficiently large to support multifamily or townhouse development (or adjacent to other land assemblage opportunities).
- Accessible to public transportation with frequent, regular service.
- In a location with that allows housing by right (in regard to zoning regulations).

Other site characteristics such as existing land use on surrounding sites and tree coverage on the site could be considered.

Timing: Short-term

3. Empower an entity to lead a regular, cross-agency assessment of opportunities for developing affordable housing on public land

This entity could be an interdepartmental staff team with expertise in planning, urban design, affordable housing, the Town's real estate holdings, and park- and facilities-planning efforts to review opportunities. It is possible that, in addition to Town staff, this entity could have representatives from other agencies involved in creating and managing affordable housing that are potential partners with the Town in this effort. That could include the Wake County Department of Housing Affordability & Community Revitalization, the Wake County Housing Authority, and others.

Authorizing a single entity/agency to consolidate public holdings sets a process for inventorying and disposing of public land. If there is no mandate to do so, municipal agencies not focused on housing are unlikely to review property holdings that could be used to expand affordable housing development.

Timing: Short-term

4. Establish a housing fund to help finance new affordable housing in the Town of Wake Forest.

As mentioned in the site acquisition section, an affordable housing funding source can be very effective in assisting with affordable housing development. Even with free or reduced cost land, it can be difficult to structure financing for affordable housing. Several jurisdictions in the Triangle Region have affordable housing bond funds that have provided critical financial assistance for affordable housing developments including the City of Raleigh ($80 million) and the City of Durham ($95 million). While the Town of Wake Forest is currently setting aside a half cent of every dollar of property taxes collected to fund affordable housing initiatives, this may not be sufficient to fully cover a land disposition program.

Timing: Medium-term, to the extent possible as a bond fund would require voter approval

5. Use public resources to help prepare sites for development.

Any activities that reduce hard and soft development costs including clearance and decontamination of a site, infrastructure provision, or advancement of area land use planning, can help enable free or discounted public land to support affordable housing. This type of investment in the sites can reduce the hard costs of development and the risk and time involved to get the sites ready for development, which reduces the need for additional public subsidy and helps attract better development proposals.

Timing: Medium-term, as the Town goes through the priority list of sites as indicated in #2 above

6. Identify sites where there is existing affordable housing that is managed by Wake County Housing Authority (WCHA), that could be expanded, and redeveloped if needed, and support the WCHA's efforts in this area.

WCHA, which was contacted for this study, has expressed a strong interest in a partnership with the Town on their properties located in Wake Forest. This could include improving or redeveloping the three primary WCHA properties and creating new affordable units where possible.

Such an effort will require additional resources. WCHA could use HUD's Rental Assistance Demonstration program, known as RAD, that allows housing authorities to leverage public and private debt equity in order to reinvest in the public housing stock, but it would like the Town's support on this endeavor. WCHA is also considering applying for a Choice Neighborhoods grant for redeveloping and potentially adding more affordable units on their properties. Choice Neighborhood grants, which leverage public and private dollars to support locally driven strategies that address struggling neighborhoods through a comprehensive approach to neighborhood transformation, requires the Town to strongly support the neighborhood transformation goal, to have a competitive application to HUD.

Timing: Short-term, working in tandem with WCHA

7. As the Town prepares for the solicitation process, build in a requirement that developers will ground lease sites.

Sites with multifamily development potential are best disposed of through a long-term developer ground lease. This will allow the Town to write down some or all of the land value in exchange for affordable housing and potentially other community benefits.

Timing: Medium-term

8. Issue a Request for Proposals (RFPs) to developers, on a site-by-site basis, who are interested in redeveloping sites into residential or mixed-use developments that include affordable housing

After sites are identified for development of affordable housing the Town should issue RFPs, site by site as the properties are identified and readied for development/redevelopment. The RFP will list the Town's goals for the particular site which would include income-targeting and income mix, long-term affordability, density and land use, and neighborhood character. Each RFP will also include:

- A precise description of the project site,
- The terms under which site is being offered on a long-term ground lease, and
- Specific directions on the required submittal including corporate documentation, qualifications and experience, project concept, financial capacity.

Prior to issuing the RFP, the Town may wish to issue a Request for Interest (RFI). The response to the RFI will help guide the requirements set forth in the RFP. There can be a substantial difference in approach to an RFP depending on whether the respondents are nonprofits, for-profits, or from outside the immediate area. The City of Raleigh issued an RFI before the RFP they prepared for the Lane-Idlewild site.

If the given project has the potential to be larger (e.g., 100 or more units), the Town may consider also issuing a Request for Qualifications (RFQ). Larger projects have the potential to attract more proposals from larger developers. Because RFPs can be expensive to produce, an RFQ process would allow the Town to select a shortlist

of qualified developers and give those developers some certainty that they have a good chance of being selected.

At the end of the selection process, whether it includes an RFI and an RFP, or for larger sites, an RFQ and an RFP, the Town must be prudent in selecting a developer/ lessee that has the financial capacity and experience to construct and operate any development.

Timing: Medium-term, site by site

9. Following the competitive selection, the Town and the developer enter into ground lease negotiations.

A typical ground lease is structured as an absolute net lease in which the lessor has no responsibilities for the construction, maintenance, and operation of the improvements. The lessee pays all property taxes, possessory use taxes, and other property-based taxes or impositions. Ground leases typically have terms over 50 years to give the tenant time to amortize their investment in their improvements.

There are several benefits for the Town to ground lease sites. One benefit is that a ground lease can generate a stream of rental payments with periodic adjustments. Another is that the Town has the ability to control the uses developed on a ground-lease property through deal terms and criteria established in the developer solicitation, including the length of affordability covenants.

There are also benefits of a ground lease to the developer lessee. By leasing, rather than buying the land, the developer does not need to raise or invest as much capital and higher investment yields therefore can be achieved. Furthermore, ground leases are universally recognized as an interest in real property and leasehold estates are insurable by title companies.

Timing: Medium-term, site by site

Program Management

1. The Town of Wake Forest should designate one staff person who serves as the coordinator for the land disposition for affordable housing program, regardless of the form the program takes.

Each of the cities and counties with land disposition programs that BAE researched has a staff person who has the land disposition program as a primary job function. This person would serve as the liaison between the Town and Housing Authority or other partner(s), oversee consultants, and act as Town Project Manager on developer solicitations and negotiations.

We envision the staff member or consultant to coordinate the Town's role in the land disposition program. This could include helping to identify public land suitable for affordable housing, arranging for any Town-led improvements to properties that would make the properties more development ready and attractive to developers, helping craft developer solicitation documents for development sites, working with partner Housing Authorities, and working with legal counsel to put together ground leases and development agreements as needed and appropriate.

This staff person should be a mid-level professional, with five or more years of experience in affordable housing planning and development in North Carolina, with strong working knowledge of state and federal housing programs that could be leveraged to structure financing for the projects that will be part of the land disposition for affordable housing program. Whether internal staff or an outside consultant, this coordinator would likely be initially housed in the Planning Department, as the Town does not intend to become its own Housing Authority. We would anticipate the salary for this position would currently be in the range of $65,000 and $80,000, not including benefits.

Timing: Short-term

2. The Town of Wake Forest should create a bench of consultants to provide assistance in disposition activities.

The Town should utilize outside consultants to support the program, particularly in the beginning as the program ramps up and the Town disposes of its available properties. The Town can issue a Request for Qualifications (RFQ) from urban design and architecture firms, financial real estate advisory firms, and land use attorneys with ground lease experience to create three benches of experts who can be available to assist with developer solicitation documents, proposal evaluations, and provide negotiation support.

Financial Review. Based on our experience providing these services, BAE estimates that assisting in the tailoring the developer solicitation (RFI and RFP) beyond the attached template, evaluating up to three developer proposals, and assisting with negotiation support through a signed Term Sheet would cost the Town approximately $20,000. More than three submittals would require additional funding.

This work would include a review of developer's financial capacity and experience, as well as reference checks, and a review of proposed project financial models and key assumptions to determine the financial viability of the proposed project.

BAE interviewed active planning firms and land use attorneys to estimate the cost to provide these services.

Design Review - Consulting fees for a design firm to review three developer submittals during proposal evaluation and then review schematic design documents at 25, 50, 75, and 100 percent thorough the negotiation process could cost $15,000 to $20,000, with $7,500 for developer concept review and the remainder for schematic design review.

Legal - If needed, legal fees for outside counsel to draft deal documents could cost $25,000. This would include the drafting of an Exclusive Negotiating Agreement (ENA), Term Sheet, Ground Lease, and Development Agreement (DA). The Town would want a draft ENA to attach to the RFP. After the first ENA is drafted, the Town could wait until developer selection to engage its legal consultants. Outside counsel with direct ground lease and development agreement experience can lead developer negotiations and draft the Term Sheet that will include all pertinent deal points for the project, the official ground lease document, and the subsequent development agreement. The Town Attorney should create, manage, and oversee all outside counsel activities.

The total annual budget, including setting aside funding to purchase an acre of land would total $594,000 in 2023 dollars. Table 6 shows the proposed annual budget to support an affordable housing program.

Table 6: Land Disposition Program Annual Budget

Use	Amount
Personnel (Liason, 1 Full Time)*(a)*	$85,000
Consulting Fees	
Financial (b)	$20,000
Design Review (c)	$20,000
Legal (d)	$25,000
Land Purchase (One Acre)	$431,000
Brokerage Fee (3% of purchase)	$13,000
Total Annual Budget	**$594,000**

Notes:
(a) Base Salary, which does not include benefits.
(b) Includes evaluation of three developer proposals and negotiation support to get to a signed Term Sheet.
(c) Review up to three developer concepts and schematic design documents.
(d) Outside counsel with ground lease experience to draft the Exclusive Negotiating Agreement, Term Sheet, and Development Agreement. This service may not be required if covered by Town Attorney.

Sources: CoStar; BAE, 2023.

This budget represents a year in which the Town undertakes a project of averaged-complexity affordable housing program without partnering with another public housing agency. If the Town partners with the Wake County Housing Authority, it may be able to save on some consulting fees. However, the Town may need to contribute some amount of the funding for consultants while the Housing Authority builds internal experience and capacity to successfully complete these projects.

Timing: Short-term, next budget cycle

Strategic Partnerships

1. The Town of Wake Forest should negotiate Memoranda of Understanding with potential housing authority and other strategic partners.

The Town should negotiate with strategic partners who can use Town funds to assist in the development of affordable housing projects. Any time the Town contributes funding to another entity that will execute Town policies, the Town should have each entity's roles and responsibilities fully enumerated before entering into the transaction.

In this case, when the Town provides funding for site acquisition, it will want to have some say in which consultants are used, project goals and developer evaluation criteria, and/or have one or more members on the developer proposal evaluation panels. Identifying the strategic partners and pre-negotiating each entity's rights and obligations will reduce the potential for future issues.

Timing: Short-term

2. The Town of Wake Forest should continue to communicate with potential development partners and make program adjustments based on their feedback, if necessary.

Affordable housing developers have a deep understanding of the local housing market and financial structures needed to bring projects to life. Therefore, it is important to occasionally check-in with these potential partners for feedback and make program adjustments if necessary.

Timing: Short-term

Affordable Housing Incentive Zoning Policy Procedures Manual

Town Council Adopted
June 27, 2023

Town of Apex
Community Development & Neighborhood
Connections Department
Planning Department
73 Hunter Street
Apex, NC 27502
919.249.3426 (Phone)

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Section 1. Overview

1.1 *Introduction*

Incentive zoning policies are intended to encourage applicants to provide a public service, such as affordable housing units or lots, in exchange for zoning-based, non-financial, and financial incentives. By adopting the Affordable Housing Plan (Plan), Town Council provided direction to establish an Affordable Housing Incentive Zoning Policy (Policy) that sets forth clear minimum recommendation criteria, applicability standards, and a menu of incentive options in exchange for developing residential affordable housing units or lots. The potential incentives outlined in this policy are intended to encourage the development and support of workforce housing in Apex. These incentives may be used alone, or in conjunction with other local, state and federal programs that assist in the creation of affordable housing.

The Affordable Housing Incentive Zoning Policy Procedures Manual (Procedures Manual) details the Town's minimum recommendations and applicability standards for the affordable housing units or lots generated through this Policy. The criteria in this Procedures Manual must be interpreted in conjunction with the Town's Unified Development Ordinance (UDO). The Affordable Housing Incentive Zoning Policy Administration Manual (Administration Manual) details specific procedures for the on-going administration of housing units or lots generated as a result of this Policy.

1.2 *Goals*

The goals of this Policy include:

(a) Providing a clear process and understanding of the Town's minimum recommendations and applicability standards for Town staff and prospective applicants;
(b) Adding affordable housing units or lots to the Town's affordable housing portfolio;
(c) Developing affordable housing units that address the Town's highest priority needs;
(d) Creating mixed-income communities, with affordable housing units integrated within residential and mixed-use market-rate developments; and
(e) Offsetting potential market-rate development revenue loss for developing affordable housing units or lots using the various available incentives.

1.3 *Applicability*

This Policy is applicable within zoning districts that allow residential and mixed-use development per Sec. 4.2.2 of the UDO. Applicants whose development meets the minimum Policy recommendations or submits an alternative proposal may apply for incentives through the Conditional Zoning and Planned Unit Development-Conditional Zoning (PUD-CZ) approval process in exchange for providing affordable housing within a development. All incentives are subject to Town Council approval through the Conditional Zoning process.

Table 1 – Minimum Policy Recommendation Applicability Standards

Minimum Development Unit Size Threshold	**Minimum Affordable Housing Rental/Ownership On-Site Unit/Lot Percentage (%)**	**Maximum Affordable AMI Percentage (%)**	**Minimum Affordability Term**
20+ Units/Lots	5%	Ownership - up to 135% AMI	Ownership – 20 Years
		Rental – up to 100% AMI	Rental – Negotiable based on income targeting

1.4 ***Alternatives***

Proposals that differ from the minimum Policy recommendations will be considered alternative proposals. The applicant should specify if the alternatives are less than, equivalent to, or greater than the minimum Policy recommendations in the Affordable Housing Proposal (AHP). An applicant is not precluded from requesting one or more zoning-based, non-financial, or financial incentives if proposing an alternative proposal (i.e. different on-site residential affordable housing unit or lot percentage, different Area Median Income (AMI) percentage, different affordability term, etc.), that differs from the Town's minimum Policy recommendation. The Town Council may approve, conditionally approve, or deny any proposal including an alternative proposal. The Town may retain the services of a consultant or outside legal counsel to review the reasonableness of the submitted proposal.

1.5 ***Organization***

Section 2 describes the application process to work with Town staff to prepare an affordable housing zoning condition as part of a Conditional Zoning application. Section 3 includes the minimum Policy recommendations associated with the affordable housing proposals. Section 4 describes the menu of zoning-based, non-financial, and financial incentives available to applicants in exchange for providing affordable housing units or lots as a public service. Detailed definitions and procedures for calculating affordable housing ownership costs, initial sales prices and AHP rental and ownership templates are provided in Appendix A, B, C, D, and E respectively.

1.6 ***Authority***

The Town Manager or designee is authorized to sign all documents on behalf of the Town that implement this Policy.

Section 2. Process

This Policy provides a menu of zoning-based, non-financial, and financial incentive options available for applicants to request in exchange for providing affordable housing units or lots on-site within a development through the Conditional Zoning and PUD-CZ approval process. A summary of the review process and schedules for Conditional Zoning and PUD-CZ applications can be found at http://www.apexnc.org/215/Applications-Schedules.

2.1 *Step 1: Pre-application Meeting*

This is the first step of the Conditional Zoning and PUD-CZ process. The applicant will have an opportunity to meet with the Town's Technical Review Committee (TRC) and Housing staff to discuss and receive feedback regarding all aspects of the proposed development and the affordable housing incentive options. The intent of the meeting is for the applicant to inquire about the various incentives potentially available in exchange for voluntarily providing affordable housing units or developable lots.

2.2 *Step 2: Town Staff Meetings*

The applicant will meet with Town staff to go over the Policy incentives and applicability standards in more detail. Staff assigned to each project will assist the applicant on how the incentives and applicability standards might be applied to the proposed development. This step will provide the applicant with the information needed for drafting and submitting the AHP concurrently with the Conditional Zoning application for Town staff to review and comment.

2.3 *Step 3: Affordable Housing Proposal Submittal*

The applicant will submit an AHP concurrently with the Conditional Zoning application. Appendix E and Appendix E provide a template of the AHP. The AHP will detail the incentives requested, number of affordable units, AMI percentage(s), tenure, affordability period, and describe how the applicant proposes to address the affordable housing component of the proposed development.

In addition, the AHP shall address the following affordable housing unit design and location recommendations:

1. Affordable housing units should be comparable to market-rate units in terms of unit type, consistency in building materials, overall quality of construction, and consistent with current building code standards for new housing construction.
2. Affordable housing lot sizes, number of bedrooms and number of garages may be less than the market-rate housing units, but in general, should have similar floorplans.
3. Affordable housing units should be dispersed through the development as evenly as possible based on project location, project size, proximity to transit, number of buildings and number of phases.

Town staff will review the AHP and work with the applicant until the AHP is finalized.

2.4 *Step 4: Affordable Housing Zoning Condition*

Once the AHP is finalized, the applicant and staff will draft the recommended affordable housing zoning conditions for consideration by the Planning Board and Town Council.

2.5 *Step 5: Affordable Housing Restrictive Covenants or Similar Instruments*

Once the Conditional Zoning application and zoning conditions are approved by Town Council, the applicant and staff will work with the Town's Legal Department to execute and record a restrictive covenant (i.e., affordable housing agreement) or similar instrument to memorialize the affordable housing terms and conditions of the approved zoning condition against the property and/or individual lots designated for the affordable housing units. A restrictive covenant or similar instrument will be drafted in partnership with the applicant recognizing the development may have other restrictions from first position lenders or other priority liens which could impact the type of instrument used to ensure the affordability period.

For rental developments, the restrictive covenant shall be recorded against the property prior to issuing the first Certificate of Occupancy. For ownership developments, the restrictive covenant shall be recorded against the individual affordable housing lots prior to issuing a building permit for such lots. The individual lots designated as affordable housing ownership units shall also be identified on the Master Subdivision Final Plat. The Town may retain the services of a consultant or outside legal counsel to review the restrictive covenant or instrument prior to recordation.

Section 3. Income Categories, Housing Tenure, AMI Percentages and Calculations

3.1 *Affordable Housing On-Site Percentage, Income Category and AMI Percentage*

The minimum recommended affordability term is twenty (20) years for affordable ownership units or lots. Rental housing terms and conditions will be negotiated on a project-by-project basis. Rental developments that target lower AMI percentages may have shorter terms that recognize the revenue loss due to the lower rents.

When an applicant proposes affordable housing units or lots within a development, the minimum recommended on-site percentage, income category, and maximum AMI percentages are shown in Table 2 for rental and ownership tenure types. The same standards are applicable for developments with mixed rental and ownership units.

Table 2 – Minimum Policy Recommendation Applicability Standards

<table>
<tr><th>Housing Tenure Type</th><th>Minimum Development Unit/Lot Size Threshold</th><th>Minimum Affordable On-Site Unit/Lot Percentage (%)[1]</th><th>Maximum Affordable AMI Percentage (%)[2,3]</th><th>Minimum Affordability Term</th></tr>
<tr><td>Ownership</td><td rowspan="2">20</td><td rowspan="2">5</td><td>135</td><td>Ownership – 20 Years</td></tr>
<tr><td>Rental</td><td>100</td><td>Rental – negotiable based on income targeting</td></tr>
</table>

[1] An affordable housing on-site unit percentage analysis was performed utilizing the following data: (1) Town rezoning applications from 2018 to 2021, (2) regional jurisdictions Affordable Housing, Density Bonus and Inclusionary Housing Ordinances within and outside of Wake County. As a result, the empirical data showed that a minimum Policy recommendation of five percent (5%) on-site for affordable housing units or lots was supported for recommendation.

[2] Based on U.S. Department of Housing and Urban Development (HUD) Raleigh, NC Metropolitan Statistical Area (MSA) Area Median Income (AMI) published income limits and North Carolina Housing Finance Agency (NCHFA) Low-Income Housing Tax Credit (LIHTC) Multifamily Tax Subsidy Program (MTSP) published income limits for the Wake County Metropolitan area.

[3] The Town is considered a high-cost area, as the Town's market-rate rents and median home sales prices are higher than most jurisdictions within Wake County. An affordable housing rental and ownership AMI analysis was performed utilizing the following: (1) regional jurisdictions Affordable Housing, Density Bonus and Inclusionary Housing Ordinances within and outside of Wake County, (2) HUD industry standards, (3) non-profit affordable housing providers, (4) market-rate-income analysis, (5) market-rate rent analysis and (6) market-rate ownership analysis. As a result, the empirical data showed that up to one hundred percent (100%) AMI for affordable housing rental units and up to one-hundred percent (135%) AMI for affordable housing ownership units was supported for recommendation.

3.2 *Affordable Housing Calculations*

Instructions and examples for calculating the maximum monthly affordable housing ownership costs and maximum initial sales prices are provided in Appendix B.

When computations for the number of on-site residential affordable housing units or lots result in a fraction, the applicability shall be as shown in Table 3.

Table 3 – Affordable Housing Unit Fraction Applicability

Fraction	Applicability
0.00 – 0.49	No Additional Affordable Housing Unit or Lot
0.50 – 0.99	Round Up & Provide Additional Affordable Housing Unit or Lot

To receive credit toward the minimum Policy recommendation of five percent (5%) on-site affordable housing ownership units within a development, the affordable housing ownership initial sales price (including unit and lot price) must be at least ten percent (10%) below the market-rate initial sales price/appraised value for the specific affordable housing ownership units based on bedroom size and affordable AMI percentage category. The residential market-rate units and the affordable housing ownership units should have similar floor plans.

Table 4 shows examples of different scenarios of when an applicant will or will not receive credit toward the minimum Policy recommendation. This threshold does not apply when an applicant is proposing to partner, sell, donate or transfer the lots to another entity or program (i.e. an affordable housing developer) who will in turn construct the residential affordable housing ownership units at an affordable initial sales price.

Table 4 – Affordable Housing Ownership Unit Credit

Bedroom Size	**Maximum Affordable AMI Percentages (%'s)**	**Market-Rate Initial Sales Price (Unit & Lot)**	**Affordable Housing Initial Sales Price (Unit & Lot)**	**Affordable Housing Initial Sales Price Percentage (%) Below Market-Rate Initial Sales Price (Min. 10%)**	**Affordable Housing Unit Credit**
3	100	$325,000	$308,750 Similar Floor Plan	5	No

Bedroom Size	Maximum Affordable AMI Percentages (%'s)	Market-Rate Initial Sales Price (Unit & Lot)	Affordable Housing Initial Sales Price (Unit & Lot)	Affordable Housing Initial Sales Price Percentage (%) Below Market-Rate Initial Sales Price (Min. 10%)	Affordable Housing Unit Credit
3	135	$350,000	$308,000 Similar Floor Plan	12	Yes

3.3 *Other Programs for Affordable Housing*

3.3.1 Ownership

An applicant may include affordable housing ownership units on-site through other state, federal or local affordable housing programs or construction partnerships. When affordable housing ownership units are proposed to be included through other state, federal, or local affordable housing programs or construction partnerships; the Town will work with all entities involved on the specific regulatory requirements of those programs or partnerships.

If an applicant is proposing to satisfy the minimum Policy recommendation of five percent (5%) on-site affordable housing ownership units through other affordable housing programs or construction partnerships, formal written agreements (i.e., MOU, development agreement, etc.) shall be in place between the entities involved. The specifics of the proposal shall be included in the applicant's AHP.

3.3.2 Rental Housing

An applicant may include affordable rental housing through other state, federal or local affordable housing programs (i.e., Section 8 Housing Choice Voucher Program, Low-Income Housing Tax Credit (LIHTC) Program, etc.) or other construction partnerships. When affordable rental units are proposed to be included through other affordable housing programs or partnerships, the Town will work with all entities involved on the specific regulatory requirements of those programs or partnerships. If an applicant is proposing to satisfy the minimum Policy recommendation of five percent (5%) on-site for the affordable rental units through other affordable housing programs or partnerships, formal written agreements (i.e., MOU, development agreement, etc.) shall be in place between the entities involved. The specifics of the proposal shall be included in the applicant's AHP as part of the Conditional Zoning application process.

3.4 *Restrictive Covenants*

Affordable housing ownership units or lots and rental housing units will be subject to a recorded restrictive covenant (i.e. affordable housing agreement), as stated in Section 2.5, that will be executed between the Town and applicant.

Affordable housing ownership units may be subject to an additional recorded restrictive covenant

(i.e. resale deed restriction agreement, shared appreciation agreement, etc.) recorded against the property between one of the following: (1) the applicant and Town, (2) the applicant and individual purchasers, (3) third party entity and individual purchasers, or (4) Town and individual purchasers that is above and beyond what is stated in Section 2.5 that restricts the affordable initial sales price and resale price during the period of affordability at the agreed upon maximum AMI percentage.

In situations where the mortgage or other program regulations prohibit a recorded restrictive covenant (i.e. resale deed restriction agreement, shared appreciation agreement, etc.) to be recorded against the property, other instruments that preserve the affordability will be utilized.

Recorded restrictive covenants shall run with the land and will remain in effect for subsequent buyers and owners. Final affordability terms and conditions will be included in the following: (1) zoning condition as approved by Town Council, and (2) memorialized in a recorded restrictive covenant against the property or lots.

Section 4. Town Incentives

An applicant may request one or more of the zoning-based, non-financial, and financial incentives listed in this section through the Conditional Zoning (CZ) or Planned Unit Development-Conditional Zoning (PUD-CZ) application. An applicant is not precluded from requesting one or more of the incentives if proposing an alternative proposal that differs from the Town's minimum Policy recommendations. All zoning-based, non-financial, and financial incentives requested by the applicant are not automatically approved and are subject to Town Council consideration and approval.

4.1 ***Zoning-Based Incentives***

The zoning-based incentives that an applicant may request include:

4.1.1 Higher Density Zoning District

An applicant may apply for a zoning district that allows more housing types and density than otherwise indicated on the 2045 Land Use Map to increase overall project density to support the provision of affordable housing.

4.1.2 Density Bonus

A density bonus encourages the production of affordable housing by allowing applicants to build more units or lots within the development than would otherwise be allowed by the proposed zoning district. If rezoning to the High-Density Multi-Family Residential-Conditional Zoning (HDMF-CZ), an applicant may propose a zoning condition that increases the allowed density above the 14 dwelling units per acre that the HDMF zoning district permits. An increase to at least 16 dwelling units per acre would be supported by this incentive.

4.1.3 Development Standards

Adjustments to the development standards listed below may be requested in order to support the development of affordable housing. In all cases, the type and amount of incentives proposed will be reviewed in conjunction with the 2045 Land Use Plan (as amended from time to time by the Town Council), including the Land Use Map and Context Areas Map, and the character of the surrounding area. The incentives listed below in (a), (b) and (c) are applicable in any CZ district, without the need to rezone to a PUD-CZ district.

a. Increased maximum building height
b. Reduced minimum building setbacks
c. Reduced minimum lot widths

4.1.4 Resource Conservation Area (RCA) Reduction

The maximum reduction in Resource Conservation Area (RCA) that may be requested is 10%. The amount of reduction that may be supported by staff will depend upon the percentage of units or lots provided as affordable housing and the amount of RCA required for the property. This incentive is applicable in any CZ district, without the need to rezone to a PUD-CZ district.

4.1.5 Parking Reductions

A reduction in the required amount of parking may be requested for developments that are pedestrian-oriented mixed-use and/or within .25-mile of an existing or planned bus stop. This incentive is applicable in any CZ district, without the need to rezone to a PUD-CZ district.

4.1.6 Sidewalk Reductions

For PUD-CZ applications located in the Rural Context Area as depicted on the 2045 Land Use Plan Context Areas Map, the Town may choose to waive the requirement in Section 2.3.4.F.1.a.iv of the UDO requiring construction of sidewalks on both sides of residential streets. In these cases, sidewalks must be provided on at least one side of all residential streets. Section 7.5.4.C of the UDO, requiring pedestrian facilities on both sides of all collector streets and thoroughfares, would not be waived.

4.2 ***Non-Financial Incentives***

Below is a list of non-financial incentives that an applicant may request through this Policy.

4.2.1 Expedited Processing

The Town, wherever possible, would consider expediting the processing of site plan and master subdivision plan applications where at least 10% of the residential units or lots are set aside for affordable housing.

4.3 ***Financial Incentives***

Below is a list of financial incentives that an applicant may request through this Policy.

4.3.1 Loan, Grants and Reimbursements

The Town may choose to provide financial assistance in the form of a grant for reimbursement of certain development fees to help offset some of the total development costs for providing residential affordable housing units or lots within a development. Funds shall be structured in a manner that directly reduces the housing cost for the end user in the form of a lower purchase price or monthly rental cost. The Town may also choose to provide financial assistance in the form of a loan or grant within a development to assist with the creation of residential affordable housing units or lots. This incentive is subject to Town funding availability, and will be evaluated on a case-by-case basis.

This incentive is also subject to the requirements set forth by the North Carolina General Statutes as listed below.

<u>North Carolina General Statue § 157-3</u>

1. If the Town chooses to provide financial assistance, at least twenty-percent (20%) of the total housing units within the development (ownership or rental) must be set-aside as affordable housing units for the exclusive use of persons of low-income earning no more than sixty-percent (60%) of AMI.

2. Financial assistance provided by the Town must be shown to flow directly to reducing the housing costs for low-income and moderate-income persons, and not diverted for other uses. For example, if $10,000 of financial assistance is provided by the Town, then the entire amount

must directly offset the housing costs of low-income and moderate-income persons and not to any market-rate units that might accompany the income-restricted units.

North Carolina General Statue § 157-9.4. Multi-family Rental Housing Projects

a. If the Town owns, operates, or provides financial assistance to a multi-family rental housing project, at least twenty percent (20%) of the total housing units in the development shall be set aside for the exclusive use of persons of low-income earning no more than sixty percent (60%) of AMI. A single developer may group projects being developed concurrently in order to meet the requirement of this subsection.

b. If an authority provides financial assistance to a multi-family rental housing project, the authority shall establish, as a condition of the assistance, requirements and procedures that insure that all units initially set aside for the exclusive use of persons of low-income earning no more than sixty percent (60%) of AMI continue to be so used for at least fifteen (15) years after the initial date on which at least fifty percent (50%) of the units in the project are occupied.

c. Financial assistance provided by the Town must be shown to flow directly to reducing the housing costs for low-income and moderate-income persons, and not diverted for other uses. For example, if $10,000 of financial assistance is provided by the Town, then the entire amount must directly offset the housing costs of low-income and moderate-income persons and not to any market-rate units that might accompany the income-restricted units.

Appendix A – Procedures Manual Definitions

Affordable Housing means housing on which the occupant is paying no more than thirty percent (30%) of gross monthly household income for housing costs, including utilities.

Affordable Housing Ownership Housing Costs means a reasonable down payment and monthly housing costs expected during the first calendar year of occupancy, including utilities or utility allowances, mortgage loan principal and interest, mortgage insurance, property taxes, homeowner's insurance, homeowner's association dues, if any, and all other property assessments, dues and fees assessed as a condition of property ownership, which does not exceed thirty percent (30%) of gross monthly household income based on a family size that is equal to the actual number of bedrooms as the affordable housing low-income ownership unit.

Affordable Housing Rental Housing Costs – means a monthly rent, including utilities in the form of a utility allowance which does not exceed thirty percent (30%) of gross monthly housing income adjusted for family size. Rents shall not exceed the maximum rent limits per bedroom size of the Raleigh, NC Area Median Income ("AMI") as most recently published by HUD and stipulated by the most recently published North Carolina Housing Finance Agency (NCHFA) Low-Income Housing Tax Credit (LIHTC) Multifamily Tax Subsidy Program (MTSP) income and rent limits for the Wake County Metropolitan Area.

Affordable Housing Incentive Zoning Policy means a set of minimum Town recommendations, applicability standards and incentive options for applicants to consider in exchange for providing residential affordable housing units or lots within a development as part of the Conditional Zoning and Planned Unit Development-Conditional Zoning (PUD-CZ) approval process.

Affordable Housing Incentive Zoning Policy Administration Manual means a manual which details policies and procedures for the on-going administration of residential affordable housing units or lots generated through the Affordable Housing Incentive Zoning Policy.

Affordable Housing Proposal (AHP) means a document submitted by an applicant as part of the Conditional Zoning application for the development which stipulates the affordable housing criteria as specified in the Affordable Housing Incentive Zoning Policy Procedures Manual for the residential affordable housing units or lots in order to assure compliance with the Affordable Housing Incentive Zoning Policy.

Affordable Housing Incentive Zoning Policy Procedures Manual means a manual which details applicability standards and procedures for residential affordable housing units or lots generated through the Affordable Housing Incentive Zoning Policy.

Affordable Housing Unit means a residential dwelling unit or lot that meets the definition of an affordable housing unit or lot as detailed in the Affordable Housing Incentive Zoning Policy Procedures Manual and Affordable Housing Incentive Zoning Policy Administration Manual through the Affordable Housing Incentive Zoning Policy.

Area Median Income means the annual median family income for the Raleigh, NC Metropolitan Statistical Area (MSA), adjusted for family size, as most recently published and defined by the U.S. Department of Housing and Urban Development (HUD).

For-Sale Residential Development means any residential development or portion of a residential development that involves the creation of one or more additional dwelling units or lots that may be lawfully sold individually.

HUD means the U.S. Department of Housing and Urban Development.

Period of Affordability means the time specified in the recorded restrictive covenant for which the required number or percentage of residential affordable housing units or lots must be preserved.

Persons of Low-Income as defined in North Carolina General Statute § 157-3 (15a) means persons in households the annual income of which, adjusted for family size, is not more than sixty percent (60%) of the local area median family income as defined by the most recent figures published by the U.S. Department of Housing and Urban Development.

Persons of Moderate Income as defined in North Carolina General Statute § 157-3 (15b) means persons deemed by the authority to require the assistance made available pursuant to this Chapter on account of insufficient personal or family income taking into consideration, without limitation, (i) the amount of the total income of such persons and families available for housing needs, (ii) the size of the person's family, (iii) the cost and condition of housing facilities available, and (iv) the eligibility of such persons and families for federal housing assistance of any type predicated upon a moderate or low and moderate income basis.

Planned Unit Development-Conditional Zoning means the zoning district established in Sec. 3.3.3.C of the UDO. This district allows for variations in development standards in order to provide a type of development that is not possible through strict application of the Ordinance.

Maximum Allowable Affordable Housing Ownership Sales Price means the highest dollar amount at which a residential affordable housing ownership unit may be sold.

Maximum Allowable Affordable Housing Rent Limit means the highest dollar amount at which a residential affordable housing rental unit may be rented including utilities or utility allowances.

Mixed-Use Residential Development means any development that contains both residential and non-residential uses.

Rental Residential Development means any residential development or portion of a residential development that creates one or more dwelling units that cannot lawfully be sold individually.

Restrictive Covenant means a legal document imposing a restriction on the use of land so that the affordability terms and conditions are memorialized for the residential affordable housing units or lots.

Utility Allowance means maintenance and utilities costs as most recently published by the U.S. Department of Veterans Affairs (VA) for affordable ownership housing and utility allowance schedule as most recently published by either the Housing Authority of the County of Wake or the Raleigh Housing Authority, NC for affordable rental housing.

VA means the U.S. Department of Veterans Affairs.

Appendix B – Affordable Housing Ownership Costs and Initial Sales Price Assumptions and Examples

Step 1:

Maximum Affordable Housing Ownership Housing Costs

The first step is to determine the maximum affordable housing ownership housing costs by AMI percentage income category (e.g., 80% AMI, 100% AMI, or 135% AMI). The maximum affordable housing ownership housing costs determines how much a household can spend toward their total ownership housing expenses (i.e. principal and interest loan payment, property taxes, homeowner's insurance, mortgage insurance, utilities, HOA and property assessments). The following steps below outline how the maximum affordable housing ownership housing costs are calculated.

Target AMI Reduction Factor

An AMI reduction factor of 10 percentage points is included in determining the maximum affordable ownership costs. This reduction serves to help ensure monthly affordability for the buyer, and increase the pool of potential buyers.

For example, if the applicant has pledged ownership units targeted to households at 100% AMI or below, the AMI Reduction Factor is 90%. If the applicant has pledged ownership units targeted to households at 80% AMI or below, the AMI Reduction Factor is 70%.

Maximum Affordable Housing Ownership Housing Costs

The following steps below outline how the maximum affordable housing ownership housing costs are calculated.

1. Obtain the maximum annual affordable housing ownership housing costs by multiplying the following:

    a. 80% AMI = Thirty percent (30%) times 70 percent (70% AMI Reduction Factor) times the annual median-income limit (100% AMI category) based on a household size that is equal to the actual number of bedrooms.

    b. 100% AMI = Thirty percent (30%) times ninety percent (90% AMI Reduction Factor) times the annual median-income limit (100% AMI category) based on a household size that is equal to the actual number of bedrooms.

    c. 135% AMI = Thirty percent (30%) times one hundred twenty five percent (125% AMI Reduction Factor) times the annual median-income limit (100% AMI category) based on a household size that is equal to the actual number of bedrooms.

The table on the next page provides an example of how to calculate the maximum affordable housing ownership housing costs for the different affordable housing AMI percentage income categories (i.e. 100%, 135% AMI) based on a four (4) bedroom affordable housing unit.

Maximum Affordable Housing Ownership Housing Costs

Affordable AMI Percentages (%)	Unit Bedroom Size	Household Size	Annual Median-Income Limit	Calculation	Maximum Monthly Affordable Housing Costs
80%AMI	4	4	$113,330	0.3 x 0.7 x $113,300 = $23,793/yr. divided by 12 = $1,982.75/mo.	$1,982.75
100%AMI	4	4	$113,300	0.3 x 0.9 x $113,300 = $30,591/yr. divided by 12 = $2,549.25/mo.	$2,549.25
135% AMI	4	4	$113,300	0.3 x 1.25 x $113,300 = $42,487.50/yr. divided by 12 = $3,540.62/mo.	$3,540.62

Step 2:

Affordable Housing Initial Sales Price Housing Costs Assumptions

After the maximum affordable housing ownership housing costs have been calculated per Step 1 above, Step 2 is to plug in the affordable housing initial sales price housing costs assumptions below in order to determine the suggested maximum affordable housing ownership initial sales price. The initial sales price housing costs (i.e. principal and interest loan payment, property taxes, homeowner's insurance, mortgage insurance, utilities, HOA and property assessments), shall not exceed the household's maximum affordable housing ownership housing costs per the applicable income category (e.g., 80% AMI, 100% AMI, 135% AMI) and bedroom size of the affordable housing unit. In order to determine the suggested maximum affordable housing ownership initial sales price, certain housing costs assumptions must be considered. The following affordable housing ownership housing costs are assumed when calculating the maximum affordable housing ownership initial sales prices.

Affordable Housing Initial Sales Price Housing Costs Assumptions

Item	Assumption
Down Payment	3.00% of Initial Sales Price
Loan Amount	97.00% Loan-To-Value (LTV) of Initial Sales Price
Loan Term	30 Year Loan Term, Fully Amortized Principal and Interest (P&I)
Interest Rate	Freddie Mac 30 Year Fixed Rate Mortgage, Most Recent Monthly Average
Private Mortgage Insurance (PMI)	0.50% of 1st Mortgage Loan Amount
Property Taxes	1.00% of Initial Sales Price
Homeowners Insurance	0.25% of Initial Sales Price
Utilities or Utility Allowance	VA Maintenance & Utility Standard
Homeowners Association (HOA) Fee	Project Specific (If Applicable)
Other Property Assessments	Project Specific (If Applicable)

Step 3:

Affordable Housing Initial Sales Prices

Once Steps 1 and 2 above have been performed, Step 3 will produce the suggested affordable housing initial sales price per income category (e.g., 80%, 100% AMI, 135% AMI) based on the bedroom size of the affordable housing unit. The tables below illustrate examples of an affordable housing initial sales price for a four (4) bedroom 80% AMI, 100% AMI and four (4) bedroom 135% AMI affordable housing ownership unit. It is important to note that these are examples, and each project will be different.

Example
4 Bedroom Suggested Maximum (80% AMI) Affordable Housing Initial Sales Price

Maximum Affordable Housing Initial Sales Price	**$276,000.00**
NCHFA Homebuyers Assistance	$15,000
Wake County Homebuyers Assistance	$50,000
Buyer Down Payment (3.0%)	$6,330.00
1st Mtg. Loan Amount (75.0%) Loan-To-Value (LTV)	$204,670.00
1st Mtg. Interest Rate	6.39%
1st Mtg. Principal & Interest (P&I) Loan Payment	$1,318.44/mo.
Property Taxes (1.0%)	$230/mo.
HOA Dues (Estimated)	$100.00/mo.
Other Property Assessments (If Applicable)	$0.00/mo.
Homeowner's Insurance (0.25%)	$43.96/mo.
Utilities – VA Standard @ 0.14 cents/sq. ft Based on 1,800 sq. ft. Unit Size	$252.00/mo.
Private Mortgage Insurance (0.50%)	$87.92/mo.
Total Housing Cost	**$1,978.14**
30% Maximum Housing Costs	**$1,982.75/mo.**
Affordable Initial Sales Price Housing Costs	**$1,978.14/mo.**

Note: The maximum affordable housing initial sales price calculation in the table above is used only for illustration and educational purposes and does not reflect any project-specific data.

Example
4 Bedroom Maximum (100% AMI) Affordable Housing Initial Sales Price

Maximum Affordable Housing Initial Sales Price	**$292,000.00**
Down Payment (3.0%)	$8,760.00
1st Mtg. Loan Amount (97.0%) Loan-To-Value (LTV)	$283,240.00
1st Mtg. Interest Rate	6.39%
1st Mtg. Principal & Interest (P&I) Loan Payment	$1,769.83/mo.
Property Taxes (1.0%)	$243.33/mo.
HOA Dues (Estimated)	$100.00/mo.
Other Property Assessments (If Applicable)	$0.00/mo.
Homeowner's Insurance (0.25%)	$60.83/mo.
Utilities – VA Standard @ 0.14 cents/sq. ft Based on 1,800 sq. ft. Unit Size	$252.00/mo.
Private Mortgage Insurance (0.50%)	$121.67/mo.
Total Housing Cost	**$2,547.66**
30% Maximum Housing Costs	**$2,549.25/mo.**
Affordable Initial Sales Price Housing Costs	**$2,547.66/mo.**

Note: The maximum affordable housing initial sales price calculation in the table above is used only for illustration and educational purposes and does not reflect any project-specific data.

Example
4 Bedroom Maximum Median-Income (135% AMI) Affordable Housing Initial Sales Price

Maximum Affordable Housing Initial Sales Price	$420,000.00
Down Payment (3.0%)	$12,600.00
1st Mtg. Loan Amount (97.0%) Loan-To-Value (LTV)	$407,400.00
1st Mtg. Interest Rate	6.39%
1st Mtg. Principal & Interest (P&I) Loan Payment	$2,545.64/mo.
Property Taxes (1.0%)	$350.00/mo.
HOA Dues (If Applicable)	$100.00/mo.
Other Property Assessments (If Applicable)	$0.00/mo.
Homeowner's Insurance (0.25%)	$87.50/mo.
Utilities – VA Standard @ 0.14 cents/sq. ft Based on 1,800 sq. ft. Unit Size	$252.00/mo.
Private Mortgage Insurance (0.50%)	$175.00/mo.
Total Housing Cost	**$3,510.14/mo.**
30% Maximum Housing Costs	**$3,540.62/mo.**
Affordable Initial Sales Price Housing Costs	**$3,510.62/mo.**

Note: The maximum affordable housing initial sales price calculation in the table above is used only for illustration and educational purposes and does not reflect any project-specific data.

Appendix C – Affordable Rental Housing Cost Calculation Example

The following steps below outline how the maximum affordable rental housing costs are calculated.

Step 1:
Maximum Affordable Rental Housing Costs
The first step is to determine the maximum affordable rental housing costs by AMI percentage income category (e.g., 60% AMI, 80% AMI or 100% AMI). The maximum affordable rental housing costs determines how much a household can spend toward their total rental housing expenses (rent and utilities).

1. Obtain the maximum annual affordable housing rental housing costs by multiplying the following:

    a. 60% AMI = Thirty percent (30%) times sixty percent (60%) times the annual median-income limit (100% AMI category) based on household size.

    b. 80% AMI = Thirty percent (30%) times eighty percent (80%) times the annual median-income limit (100% AMI category) based on household size.

    c. 100% AMI = Thirty percent (30%) times one hundred percent times the annual median-income limit (100% AMI category) based on household size.

Maximum Affordable Rental Housing Costs

AMI	1 person	2-person	3-person	4-person	5-person
60%	$ 1,191.00	$ 1,360.50	$ 1,530.00	$ 1,699.50	$ 1,836.00
80%	$ 1,588.00	$ 1,814.00	$ 2,040.00	$ 2,266.00	$ 2,448.00
100%	$ 1,985.00	$ 2,267.50	$ 2,550.00	$ 2,832.50	$ 3,060.00

Step 2:
Affordable Rental Housing – Maximum Suggested Rent Assumptions
Rents shall be marketed at maximum rent limits per bedroom size, based on the most recently published North Carolina Housing Finance Agency (NCHFA) Low-Income Housing Tax Credit (LIHTC) Multifamily Tax Subsidy Program (MTSP) income and rent limits for the Wake County Metropolitan Area

*A monthly utility allowance shall be provided consistent with the procedures outlined by the North Carolina Housing Finance Agency.

Maximum Rent (2022 MTSP - Wake County)

AMI	Efficiency	1-bedroom	2-Bedroom	3-bedroom	4-bedroom
60%	$ 1,123.00	$ 1,203.00	$ 1,444.00	$ 1,669.00	$ 1,863.00
80%	$ 1,498.00	$ 1,605.00	$ 1,926.00	$ 2,226.00	$ 2,484.00
100%	$ 1,872.00	$ 2,006.00	$ 2,406.00	$ 2,782.00	$ 3,104.00

Note: Maximum rents will be updated annually as approved by the North Carolina Housing Finance Agency

Step 3:

Determining Final Rent Amount

Rents shall not exceed 30% of monthly gross income adjusted for household size for the agreed upon income category. Rents shall be the lesser of the maximum rent based on bedroom size, or 30% of gross income of the agreed upon income category. In no case shall the rents charged be more than the non-restricted units, based on bedroom size, throughout the development.

*A monthly utility allowance shall be provided consistent with the procedures outlined by the North Carolina Housing Finance Agency.

Example: 80% AMI Restricted Units – 1-bedroom apartment
Maximum Affordable Rental Costs:

80% AMI	Max. Cost.	Max Rent
1 person	$1,588.00	$ 1,588.00
2-person	$1,814.00	$ 1,605.00

Example: 80% AMI Restricted Units – 2-bedroom apartment
Maximum Affordable Rental Costs:

80% AMI	Max. Cost.	Max Rent
1 person	$1,588.00	$ 1,588.00
2-person	$1,814.00	$ 1,814.00
3-person	$2,040.00	$ 1,926.00
4-person	$2,266.00	$ 1,926.00

Appendix D – Affordable Rental Housing Proposal Development Template

Submittal Date: _____

Submittal No.: _____

Applicant/Project Information:

Conditional Zoning Case #:

_____

_____

Name of Applicant: _____

Applicant Representative Contact Information (Name, Phone and E-mail Address):

_____

_____

Name of Development: _____

Name of Market-Rate Builder/Developer: _____

Name of Affordable Housing Builder/Developer: _____

Site Address: _____

Policy Incentives (See Policy Procedures Manual For Full Incentive Descriptions):
Please check the Policy incentives being requested for the development from the list below and provide a description of the request.

1. Higher Density Zoning District (Zoning-Based) ☐

   Description of Request (i.e. Requesting rezoning from Rural Residential (RR) to Medium Density Residential-Conditional Zoning (MD-CZ)): _____

   _____

2. Density Bonus High Density Multi-Family Residential-Conditional Zoning (HDMF-CZ) (Zoning-Based) ☐

   Description of Request (i.e. Requesting a minimum of 16 du/ac): _____

   _____

3. Increased Maximum Building Height (Zoning-Based) ☐

Description of Request (i.e. Requesting an additional xx feet): _____

_____

4. Reduced Minimum Building Setbacks (Zoning-Based) ☐

   Description of Request (i.e. Requesting a reduction from xx feet to xx feet): _____

   _____

5. Reduced Minimum Lot Widths (Zoning-Based) ☐

   Description of Request (i.e. Requesting a reduction from xx feet to xx feet): _____

   _____

6. Resource Conservation Area (RCA) Reduction (Zoning-Based) ☐

   Description of Request (i.e. Requesting a reduction of xx percent):

   _____

   _____

7. Parking Reductions (Zoning-Based) ☐

   Description of Request (i.e. Requesting reduction of parking standards from xx spaces to xx spaces or xx spaces per unit to xx spaces per unit): _____

   _____

8. *Sidewalk Reductions (Zoning-Based) ☐

   Description of Request (i.e. Requesting to waive UDO requirement to construct sidewalks on both sides of residential streets): _____

   _____

   **Note: Incentive is only available in Rural Context Area as depicted on the Town of Apex Context Area Map.*

9. *Expedited Processing of Site Plan and Master Subdivision Plan Applications (Non-Financial) ☐

   Description of Request (i.e. Requesting expedited processing of Site Plan or Master Subdivision Plan): _____

   _____

   **Note: Min. 10% of the residential units or lots to be set aside for affordable housing in order to qualify for this incentive.*

10. *Loans, Grants and Reimbursements (Financial) ☐

    Description of Request (i.e. Requesting a fee reimbursement in the amount of $xx for the water capital

reimbursement fee): _____

_____

**Note: Min. 20% of the residential units or lots to be set aside for affordable housing and not to exceed 60% AMI in order to qualify for this incentive. Subject to North Carolina General Statutes § 157-3 and § 157-9.4*

Affordable Rental Housing Proposal Summary Information:

Rental Development		
Policy Item	**Minimum Policy Recommendations**	**Applicant Proposal** **(If Not Proposing Minimum Policy Recommendations, The Proposal Is Considered An Alternative Proposal)**
Min. Affordable Housing Rental On-Site Unit Percentage (%)	5.0%	
Maximum Affordable Rental AMI% and Income Category	100% AMI	
Minimum Affordability Term	Negotiable	
Affordable Housing Rental Unit Administration (i.e. Property Management Functions)	Applicant or Applicant's Property Management Company	

Alternative Proposals:

If submitting an alternative proposal that is different than the minimum Policy recommendations (i.e. different on-site unit %, different maximum AMI %, different affordability term, etc.), please submit reason here:

_____

_____

_____

_____

Other Policy Unit/Design Recommendations:

1. Residential affordable housing units should be comparable to market-rate units in terms of unit type, consistency in building materials, overall quality of construction, and consistent with

current building code standards for new construction housing.

2. Residential affordable housing lot sizes, number of bedrooms and number of garages may be less than the market-rate housing units.
3. Residential affordable housing units should be dispersed through the development as evenly as possible based on project location, project size, proximity to transit, number of buildings and number of phases.

Market-Rate Development Information

Total Number of Market-Rate Rental Units Proposed: _____

Total Number of Residential Buildings: _____

Market-Rate Rental Unit Types (please check all that apply below):

☐ Single-Family Detached

☐ Single-Family Attached

☐ Townhouse Detached

☐ Townhouse Attached

☐ Apartments

☐ Other, Please Specify _____

Market-Rate Rental Unit Bedroom Sizes (please check all that apply below):

☐ Studio/SRO/Efficiency

☐ 1 Bedroom

☐ 2 Bedroom

☐ 3 Bedroom

☐ 4 Bedroom

Estimated Market-Rate Rental Unit Sizes (please check and insert all that apply below):

☐ Studio/SRO/Efficiency = _____ (sq./ft.)

☐ 1 Bedroom = _____ (sq./ft.)

☐ 2 Bedroom = _____ (sq./ft.)

☐ 3 Bedroom = _____ (sq./ft.)

☐ 4 Bedroom = _____ (sq./ft.)

*Estimated Market-Rate Monthly Rent Prices (please check and insert all that apply below):

☐ Studio/SRO/Efficiency = $_____/mo.

☐ 1 Bedroom = $_____/mo.

☐ 2 Bedroom = $_____/mo.

☐ 3 Bedroom = $_____/mo.

☐ 4 Bedroom = $_____/mo.

**Market-Rate Monthly Rent Prices Subject to Change*

Affordable Rental Housing Summary Information

Total Number of Affordable Rental Units Proposed: _____

Will affordable rental units be subsidized by other programs (i.e. Section 8 Housing Choice Voucher, Low-Income Housing Tax Credit (LIHTC), etc.)? If Yes, Please List Programs:

_____

How will you notify residents of affordable rental opportunities (i.e. interest list, waiting list, application period, etc.) for this development?

_____

_____

_____

Affordable Housing Rental Unit Types (please check all that apply below):

☐ Single-Family Detached

☐ Single-Family Attached

☐ Townhouse Detached

☐ Townhouse Attached

☐ Apartments

☐ Other, Please Specify _____

Affordable Housing Rental Unit Bedroom Sizes, Number of Affordable Units and Maximum Affordable AMI % (please check and insert all that apply below):

☐ Studio/SRO/Efficiency

# of Affordable Units = _____ @ _____ AMI %

☐ 1 Bedroom

# of Affordable Units = _____ @ _____ AMI %

☐ 2 Bedroom

# of Affordable Units = _____ @ _____ AMI %

☐ 3 Bedroom,

# of Affordable Units = _____ @ _____ AMI %

☐ 4 Bedroom

# of Affordable Units = _____ @ _____ AMI %

Estimated Affordable Housing Rental Unit Sizes (please check and insert all that apply below):

☐ Studio/SRO/Efficiency = _____ (sq./ft.)

☐ 1 Bedroom = _____ (sq./ft.)

☐ 2 Bedroom = _____ (sq./ft.)

☐ 3 Bedroom = _____ (sq./ft.)

☐ 4 Bedroom = _____ (sq./ft.)

*Estimated Affordable Housing Maximum Monthly Rent Limits (Including Utilities) and Maximum Affordable AMI %:
Note: Town staff to provide this information to Applicant

☐ Studio/SRO/Efficiency = $_____/mo. @ _____ AMI %

☐ 1 Bedroom = $_____/mo. @ _____ AMI %

☐ 2 Bedroom = $_____/mo. @ _____ AMI%

☐ 3 Bedroom = $_____/mo. @ _____ AMI %

☐ 4 Bedroom = $_____/mo. @ _____ AMI %

**Affordable Housing Maximum Monthly Rent Limits Subject to Change*

Applicant Authorized Representative:

_____
Insert Name & Job Title

Reviewed and Approved By:

_____
Insert Town Staff Name & Job Title

Appendix E – Affordable Ownership Housing Proposal Development Template

Submittal Date: _____

Submittal No.: _____

Applicant/Project Information:

Conditional Zoning Case #:

_____

_____

Name of Applicant: _____

Applicant Representative Contact Information (Name, Phone and E-mail Address):

_____

_____

Name of Development: _____

Name of Market-Rate Builder/Developer: _____

Name of Affordable Housing Builder/Developer: _____

Site Address: _____

Policy Incentives (See Policy Procedures Manual For Full Incentive Descriptions):
Please check the Policy incentives being requested for the development from the list below and provide a description of the request.

1. Higher Density Zoning District (Zoning-Based) ☐

   Description of Request (i.e. Requesting rezoning from Rural Residential (RR) to Medium Density Residential-Conditional Zoning (MD-CZ)): _____

   _____

2. Density Bonus High Density Multi-Family Residential (HDMF)-Conditional Zoning (CZ) (Zoning-Based) ☐

   Description of Request (i.e. Requesting a minimum of 16 du/ac): _____

   _____

3. Increased Maximum Building Height (Zoning-Based) ☐

   Description of Request (i.e. Requesting an additional xx feet): _____

_____

4. Reduced Minimum Building Setbacks (Zoning-Based) ☐

   Description of Request (i.e. Requesting a reduction from xx feet to xx feet): _____

   _____

5. Reduced Minimum Lot Widths (Zoning-Based) ☐

   Description of Request (i.e. Requesting a reduction from xx feet to xx feet): _____

   _____

6. Resource Conservation Area (RCA) Reduction (Zoning-Based) ☐

   Description of Request (i.e. Requesting a reduction of xx percent):

   _____

   _____

7. Parking Reductions (Zoning-Based) ☐

   Description of Request (i.e. Requesting reduction of parking standards from xx spaces to xx spaces or xx spaces per unit to xx spaces per unit): _____

   _____

8. *Sidewalk Reductions (Zoning-Based) ☐

   Description of Request (i.e. Requesting to waive UDO requirement to construct sidewalks on both sides of residential streets): _____

   _____

   **Note: Incentive is only available in Rural Context Area as depicted on the Town of Apex Context Area Maps.*

9. *Expedited Processing of Site Plan and Master Subdivision Plan Applications (Non-Financial) ☐

   Description of Request (i.e. Requesting expedited processing of Site Plan or Master Subdivision Plan): _____

   _____

   **Note: Min. 10% of the residential units or lots to be set aside for affordable housing in order to qualify for this incentive.*

10. *Loans, Grants and Reimbursements (Financial) ☐

    Description of Request (i.e. Requesting a fee reimbursement in the amount of $xx for the water capital reimbursement fee): _____

**Note: Min. 20% of the residential units or lots to be set aside for affordable housing and not to exceed 60% AMI in order to qualify for this incentive. Subject to North Carolina General Statutes § 157-3 and § 157-9.4*

Affordable Housing Proposal Summary Information:

Ownership Development		
Policy Item	**Minimum Policy Recommendations**	**Applicant Proposal (If Not Proposing Minimum Policy Recommendations, The Proposal Is Considered An Alternative Proposal)**
Min. Affordable Housing Ownership On-Site Unit/Lot Percentage (%)	5.0%	
Maximum Affordable Ownership AMI% and Income Category	135% AMI	
Minimum Affordability Term	20 Years	
Affordable Housing Ownership Unit Administration (i.e. Resales, Refinances, Annual Occupancy Verifications, etc.)	See Options To Right	Please Circle Option Option 1: Applicant (In-House) Option 2: Third-Party Administrator (i.e. an affordable housing developer.) Insert Third-Party Administrator Name: _____ Option 3: Town of Apex

Alternative Proposals:

If submitting an alternative proposal that is different than the minimum Policy recommendations (i.e. different on-site %, different AMI %, different affordability term, etc.), please submit reason here:

_____

_____

_____

Other Policy Unit/Design Recommendations:

1. Residential affordable housing units should be comparable to market-rate units in terms of unit type, consistency in building materials, overall quality of construction, and consistent with current building code standards for new construction housing.
2. Residential affordable housing lot sizes, number of bedrooms and number of garages may be less than the market-rate housing units.
3. Residential affordable housing units should be dispersed through the development as evenly as possible based on project location, project size, proximity to transit, number of buildings and number of phases.

Market-Rate Development Summary Information

Total Number of Market-Rate Ownership Units Proposed: _____

Total Number of Phases Proposed: _____

Estimated Monthly HOA Dollar Amount: $_____

Market-Rate Ownership Unit Types (please check all that apply below):

☐ Single-Family Detached

☐ Single-Family Attached

☐ Condominium

☐ Townhouse Detached

☐ Townhouse Attached

☐ Other, Please Specify _____

Market-Rate Ownership Unit Bedroom Sizes (please check all that apply below):

☐ 1 Bedroom

☐ 2 Bedroom

☐ 3 Bedroom

☐ 4 Bedroom

☐ 5 Bedroom

Estimated Market-Rate Ownership Unit Sizes (please check and insert all that apply below):

☐ 1 Bedroom = _____ (sq./ft.)

☐ 2 Bedroom = _____ (sq./ft.)

☐ 3 Bedroom = _____ (sq./ft.)

☐ 4 Bedroom = _____ (sq./ft.)

☐ 5 Bedroom = _____ (sq./ft.)

*Estimated Market-Rate Ownership Unit Initial Sales Prices (Unit Price + Lot Price) (please check and insert all that apply below):

☐ 1 Bedroom = $_____

☐ 2 Bedroom = $_____

☐ 3 Bedroom = $_____

☐ 4 Bedroom = $_____

☐ 5 Bedroom = $_____

**Market-Rate Ownership Initial Sales Prices Subject to Change*

Affordable Housing Ownership Summary Information

Total Number of Affordable Housing Ownership Units/Lots Proposed: _____

Will Affordable Housing Ownership Lot(s) Be Sold/Transferred To Another Entity (i.e. an affordable housing developer)? _____

If Yes, To Question Above, Please Insert Name of Entity: _____

In Which Phase(s) Will Affordable Housing Ownership Units Be Constructed? _____

How Will You Notify Residents of Affordable Housing Ownership Opportunities (i.e. interest list, waiting list, application period, etc.) For This Development?

_____

_____

_____

Affordable Housing Ownership Unit Types (please check all that apply below):

☐ Single-Family Detached

☐ Single-Family Attached

☐ Condominium

☐ Townhouse Detached

☐ Townhouse Attached

☐ Other, Please Specify _____

Affordable Housing Ownership Unit Bedroom Sizes, Number of Affordable Units and Maximum Affordable AMI % (please check and insert all that apply below):

☐ 1 Bedroom

# of Affordable Units = _____ @ _____ AMI %

☐ 2 Bedroom

# of Affordable Units = _____ @ _____ AMI %

☐ 3 Bedroom

# of Affordable Units = _____ @ _____ AMI %

☐ 4 Bedroom

# of Affordable Units = _____ @ _____ AMI %

☐ 5 Bedroom

# of Affordable Units = _____ @ _____ AMI %

Estimated Affordable Housing Ownership Unit Sizes (please check and insert all that apply below):

☐ 1 Bedroom = _____ (sq./ft.)

☐ 2 Bedroom = _____ (sq./ft.)

☐ 3 Bedroom = _____ (sq./ft.)

☐ 4 Bedroom = _____ (sq./ft.)

☐ 5 Bedroom = _____ (sq./ft.)

*Estimated Affordable Housing Ownership Unit Maximum Initial Sales Prices (Unit Price + Lot Price)
Note: Town staff to provide this information to Applicant

☐ 1 Bedroom = $_____ @ _____ AMI %

☐ 2 Bedroom = $_____ @ _____ AMI%

☐ 3 Bedroom = $_____ @ _____ AMI %

☐ 4 Bedroom = $_____ @ _____ AMI %

☐ 5 Bedroom = $_____ @ _____ AMI %

**Affordable Housing Ownership Maximum Initial Sales Prices Subject to Change*

Applicant Authorized Representative:

_____
Insert Name & Job Title

Reviewed and Approved By:

_____
Insert Town Staff Name & Job Title

Evaluation and Disposition of County-owned Land for Affordable Housing

X	Countywide		Department:		Division:
Supersedes: N/A				Effective Date: 09/01/2019	
Authority: County Manager					
Originating Department: Housing Affordability & Community Revitalization (Housing Department)					

I. Purpose: The purpose of this policy is to establish uniform procedures and standards to be used by Wake County for the evaluation and disposition of available County-owned properties and other publicly-owned properties for the development of affordable housing. This policy is enacted to comply with N.C.G.S. 160D-1316.

II. Policy Statement: Evaluating County-owned property for potential affordable housing development is a good use of existing County resources and a potential resource for creating mixed-income communities and supporting residents' access to opportunity. Prior to disposing of County-owned properties, Wake County shall evaluate County-owned properties for affordable housing use, including physical feasibility, suitability, necessity, and alignment with County policy priorities regarding affordable housing development. In addition to any other County policies and inventory management procedures, Wake County shall use the criteria set forth in Sections A and B of this policy for evaluating potential use of County or other public-owned property for affordable housing.

Except as otherwise delegated by the Wake County Board of Commissioners, final decisions regarding the disposition of County-owned property shall be made on a case-by-case basis by the Wake County Board of Commissioners. N.C.G.S. 160A-266 "Methods of sale; limitation" shall apply regardless of recommending or designating the property for affordable housing development. Wake County deems the use of property for affordable housing a public purpose such that private negotiation and sale may also be permitted as authorized by G.S. 160A-266 and G.S. 160A-279 "Sale of property to entities carrying out a public purpose; procedure".

A. Multifamily Land Disposition

Criteria	Preferred Condition	Filtered Out
Ownership	1. County-owned 2. Wake County Board of Education-owned 3. Municipal-owned	• Publicly-owned, federal • Privately-owned • County-designated open space
I. Site Conditions—Determining physical feasibility		

Lot Size	1. Properties >= 1 acre	• Less than 1 acre
Built Area	1. Vacant 2. Underutilized - ratio of heated area to total lot size is < 60%	• Lots with > 60% building coverage • Fully built
Floodplain	1. Not in floodplain 2. <50% of property in floodplain	Majority of parcel is in floodplain
Topography	1. Flat 2. Sloped, slight	• Sloped, steep
Utilities	1. Existing utility connections	*Sites without existing utility infrastructure that meet other physical criteria can be considered for future development*
Access	1. Existing paved road access to parcel	*Sites without existing paved road access that meet other physical criteria can be considered for future development*
Incompatible Use	1. Site is not currently occupied by an incompatible use (e.g. landfill, manufacturing facility)	*Sites currently in use for a purpose incompatible with housing can be considered for future development if use changes*

II. Site Suitability—Applying policy priorities to sites that are physically feasible for housing	
Criteria	**Desired Characteristics**
Encumbrances	• No existing deed restrictions • No encumbrances • County's title is free and clear of restrictions
Proximity to Existing Residential and Commercial	• Within 500 feet of existing residential • Within 0.5 mile of existing commercial
Connectivity	• Within 0.25 mile of existing high-frequency transit • Within 0.25 mile of planned high-frequencytransit • Within 0.5 mile of existing transit • Within 0.5 mile of planned transit stations • Within 0.25 mile of existing sidewalk
Zoning	• Multifamily residential • Single-family residential • Mixed-use
Proximity to Basic Services	• Within 1 mile of a grocery store • Within 1 mile of a pharmacy
LIHTC Eligibility	• Score of at least 59 according to NC QAP scoring criteria for 9% deals
Market Strength	• Recent/pipeline multifamily, office, retail, and/or hotel development within 1-mile radius • Located in a community likely to support affordable housing

Properties that are both physically feasible and suitable for multifamily affordable housing may be recommended by the Housing Affordability & Community Revitalization Department (Housing Department) for disposition through private sale.

Multifamily Disposition Process: A competitive request for proposals (RFP) process will be used to dispose of properties under this policy. As part of the RFP, the County will require detailed financial projections of the proposed development. The County will review each project's financial projections to evaluate the level of discount to land price necessary and will consider which proposal maximizes public benefits.

The Housing Department shall oversee the development of the RFP and manage the selection process, with assistance and review from other County departments as needed.

B. Single Family Disposition

Often, the County may own properties that are less than one acre in size. These properties will be assessed for single family, affordable housing development or preservation. Should development or acquisition be feasible for affordable housing, the property will be recommended for disposition through private sale.

Single Family Disposition Process: The Housing Department maintains a list-serve of single-family affordable housing developers, investors, partners and interested parties. Should a property be deemed eligible for single family disposition, a notification will be sent to the list-serve and published on the website. The Housing Department will receive offers to purchase by the date designated in the list-serve email. The Housing Department shall have oversight responsibility for reviewing Offers to Purchase; and shall direct specific inquiries to Facilities, Design and Construction, Revenue, Finance and Legal, to evaluate each offer by analyzing the following:

- Property Features: fair market value, appraised value, and assessed tax value
- Applicant Information: financial projections or income information
- Legal sufficiency of Offer

These factors will allow the County to evaluate the level of discount necessary to maintain affordability and consider which offer maximizes public benefits according to the Housing Affordability Requirements of this policy.

C. Wake County Board of Education Disposition

Properties recommended for disposition by the Wake County Board of Education ("WCBOE surplus property") may also be evaluated in accordance with this policy. For purposes of this section, the evaluation criteria shall be the same as set forth in Section A and shall be administered in conjunction with the Wake County Board of Commissioner's

consideration of any proposed sale of WCBOE surplus property, including Wake County's right of first refusal set forth under G.S. 115C-518.

III. Housing Affordability Requirements: Under the Evaluation and Disposition of County-owned Land for Affordable Housing Policy, the County's priority is realizing the deepest level of affordability possible. As such, the policy will prioritize the following target levels of affordability:

1. Rental units affordable at or below 30-40% Area Median Income (AMI);
2. When this level of affordability is not feasible, the County will accept rental units affordable at or below 40% - 60% AMI; and
3. For sale units affordable to populations at or below 80% AMI.

Rental units will maintain an affordability period of at least 30 years, and for-sale units will maintain an affordability period of at least 30 years.

These affordability minimums exceed levels set by G.S. 157-9.4, which mandates multifamily rental projects owned, operated, or financially assisted by a Housing Authority contain a minimum of 20% of all units affordable to populations at or below 60% AMI, for a minimum of 15 years.

The County may choose to require only a portion of the housing units developed on the site meet the affordability requirement, resulting in a mixed-income development. The County may sell land at a discount for a mixed-income development to support neighborhood revitalization, deconcentrate poverty, use the value of market rate housing units to further subsidize the cost of affordable housing units, or to achieve other public benefits.

The County may enforce terms of affordability through deed restrictions with a reverter clause in any conveyances.

If a property is sold before the end of the affordability period, it will be subject to the Resale/Recapture Provisions as stated in the Wake County Housing Department Policy and Procedures Manual.

IV. Definitions:

1. **Affordability period** – The minimum period of time during which a property must comply with affordability rules and regulations, including income and rent restrictions.
2. **Affordable housing** - In general, housing for which the occupant(s) is/are paying no more than 30 percent of their income for gross housing costs, including utilities.

3. **Area median income (AMI)** – Household income for the median, or middle, household in a designated region. Percentages of AMI determines income limits by household composition for program eligibility.
4. **Housing Affordability & Community Revitalization Department (Housing Department)** A division of Wake County Government responsible for identifying and addressing affordable housing needs within Wake County through funding, acquisition, and development. The Housing Department is under the general control of the Wake County Manager and Board of Commissioners.
5. **Disposition** – A conveyance of real property owned by the County, excluding encroachment agreements, right of entries, easements, right of way agreements or properties subject to continuation of existing leases. With respect to the Wake County Board of Education, any real property disposition requiring approval by the Wake County Board of Commissioners in accordance with G.S. 115C-518.
6. **Low-income housing tax credit (LIHTC)** – Federal government's primary program for encouraging the investment of private equity in the development of affordable rental housing for low to moderate-income households.
7. **Multifamily housing** – A building with more than four residential units.
8. **Request for proposals (RFP)** – A document that solicits proposals, often made through a bidding process, by an agency or company interested in procurement of a commodity, service, or valuable asset.
9. **Single family housing** - A single-unit family residence, detached or attached to other housing structures, consisting of four or less residential units.
10. **U.S. Department of Housing and Urban Development (HUD)** - U.S. government agency created in 1965 to support community development and homeownership.

V. Applicability: North Carolina recognizes the provision of affordable housing in cases of demonstrated need as fulfilling an allowable constitutional public purpose when necessary. State law enables local government units to dispose of property at below market-value through a private sale to develop affordable housing when the planning, construction, and financing of decent residential housing is not otherwise available. The reduction in fair market value cannot exceed the discount needed to make on-site affordable housing development feasible, and the conveyance of property at this reduced value must be conditional on successful delivery, and maintenance, of affordable units.

The Evaluation and Disposition of County-owned Land for Affordable Housing Policy is intended to supplement existing State law and County policies regarding disposition of property and real estate decisions presented to the County Board of Commissioners. When staff present recommendations regarding the disposition of County-owned property to the Board of Commissioners, an assessment of the property's feasibility and suitability for affordable housing will be included in the materials provided to the Board

of Commissioners for the Board's consideration alongside of any other identified County needs or uses for the property provided by other Departments. If the Housing Department has determined that the property does not meet feasibility and suitability criteria for affordable housing at any stage of the evaluation process, this information shall be included in the materials provided to the Board of Commissioners.

VI. Policy Responsibility and Management: The Housing Affordability & Community Revitalization Department will oversee implementation of this policy, including coordinating the development of the RFP, evaluating developer responses, and monitoring developments to ensure compliance with affordability requirements. This policy will be reviewed annually to ensure currency and compliance with state or federal mandates, as well as community need.

VII. Related Policies, Procedures, and Publications:

1. Wake County Housing Department Policy and Procedures Manual
2. North Carolina Legal Requirements Governing Land Disposition for Affordable Housing, developed by HR&A Advisors
3. Overview of Site Evaluation Process, developed by HR&A Advisors

VIII. Appendices: none

IX. History:

Effective Date	Version	Section(s) Revised	Author
09/01/2019	original	n/a	Housing Affordability & Community Revitalization Department
07/01/2021	two	Updated General Statute due to repeal of G.S. 153A Article 18, clarified G.S. 157-9.4 is if acting as Housing Authority.	Housing Affordability & Community Revitalization Department

TOWN *of*
WAKE FOREST

REQUEST FOR PROPOSALS (RFP #24-0001)

for the

PURCHASE AND DEVELOPMENT OF TOWN OF WAKE FOREST PROPERTY

DATE ISSUED
Monday, January 8, 2024

QUESTIONS AND CLARIFICATIONS DUE DATE
Friday, January 26, 2024
2:00 p.m.

DUE DATE
Friday, April 19, 2024
2:00 p.m.

E-Mail Address Submittal (Preferred)
bwest@wakeforestnc.gov

Physical Acceptance Location (flash drive only)
Town of Wake Forest Town Hall
Attn: Brad West, Long Range Planning Manager
301 South Brooks Street, Ground Floor
Wake Forest, NC 27587-2901

Mailing Address (flash drive only)
Town of Wake Forest Town Hall
Attn: Brad West, Long Range Planning Manager
301 South Brooks Street
Wake Forest, NC 27587-2901

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Notice

The Town of Wake Forest (as referred to as "the Town" or "Wake Forest") is seeking qualified firm(s) or organization(s) to submit proposals for the purchase or lease of [two] (2) Town-owned properties for the construction of attractive, contextually sensitive housing on approximately 1.5 acres that will be made available for affordable housing opportunities. The method of disposition will be determined by the Town and guided by applicable state laws, which require the proposer to develop a project that provides significant public benefit. The existing zoning of Renaissance Area Historic Core (RAHC) must be utilized.

I. Background

Town of Wake Forest

Wake Forest is part of the Research Triangle, one of the fastest growing regions in the country, and located minutes from Raleigh, the state capital. In the past few decades, Wake Forest has transformed from a small, rural town into a thriving suburban community with an estimated population greater than 50,000.

While this growth has brought forth many opportunities to the Town, a number of challenges have also emerged. One significant challenge experienced by many current and prospective residents of Wake Forest is the cost of housing. Increased costs have not only made purchasing a home difficult, but have also made renting prohibitively expensive.

In response to rising home prices, the Town adopted a Housing Affordability Plan in 2022, which called for the creation of a Land Disposition Program for the purpose of providing affordable housing. This RFP is being offered as part of the Land Disposition Program to create affordable housing units by selling or leasing Town-owned property.

Location and Site Characteristics

The subject properties are located at 101 and 102 Affordability Way. The lots are all vacant and Town-owned.

- Zoning is Renaissance Area Historic Core (RAHC) per the Unified Development Ordinance (UDO)
- As of October 1st, 2023, the lots are sized and appraised as follows:

101 Affordability Way 0.77 acres $ XXX,XXX.XX
102 Affordability Way 0.73 acres $ XXX,XXX.XX
Total Appraised Value: $ XXX,XXX.XX

[INSERT MAP]

II. Development Objectives

The Town has the following development objectives for the subject property:

1. **Affordable ownership and rental housing**. The development should incorporate a mix of affordable rental units targeted for individuals and families at 60 percent area median income (AMI) or lower, or affordable owner-occupied units targeted at 80 percent AMI or lower. The Town of Wake Forest utilizes the Raleigh Metropolitan Statistical Area (MSA) AMI thresholds, as defined by the U.S. Department for Housing and Community Development (HUD).

2. **Quality design**. The proposed development should incorporate context-sensitive design, with an emphasis on attractive housing structures that engage streetscapes and common open space areas.

3. **Sale or Lease.** The Town of Wake Forest intends to either sell the subject property or offer a 55-year ground lease.

4. **Long-term Affordability.** The proposed development should maximize the duration of affordable housing units with a minimum of 15 years for ground lease projects or in perpetuity for land sale projects.

5. **Multiple stories with an active ground floor use.** The proposed development should be at least two stories in height and contain a non-residential active use on the ground floor.

6. **Partnership with a for-profit or non-profit.** The Town is interested in partnering with either a for-profit or non-profit developer, each with respective statutory considerations.

III. Statutory Requirements

The State of North Carolina has specific statutory requirements that govern how local governments may sell or lease land for the purpose of building affordable housing, which will impact a proposal:

Note: The Town does not act as, or utilize the powers of, a Housing Authority per §157-9. The following statutory requirements are permitted by local governments without Housing Authority powers per §160D-1316, §160A-278, and §160A-279.

Leasing Land for the Creation of Rental Units

- Under state law *§160A-278 Lease of land for housing*, at least 20 percent of rental units should be made available to households earning up to 60 percent area median income (AMI) for the Raleigh Metropolitan Statistical Area (MSA), as defined by the U.S. Department for Housing and Community Development (HUD).

- The remaining 80 percent of units can be restricted to higher affordable income levels or unrestricted. However, the Town must obtain fair market value for its land, either through payment and/or community benefits, which include affordable housing.

Leasing Land for the Creation of For Sale Units

- Under state law *§160A-278 Lease of land for housing*, if proposing for sale units, at least 20 percent should target households earning 80 percent of AMI and should have sale prices that do not exceed the State's Community Home Buying Programs' maximum sale prices. https://www.nchfa.com/home-buyers/community-home-buying-programs.
- The same requirements for community benefits or receipt of fair market value for rental housing sites apply to for-sale housing sites.

Selling Land for the Creation of Rental Units

- Under state law *§160D-1316 Low- and moderate-income housing programs* and §*160A-279, Sale of property to entities carrying out a public purpose; procedure*, local governments may sell land for the purpose of building affordable housing, but the price of the land must reflect fair market value, unless the buyer is a non-profit entity. Fair market value appraisal may take into account the reduced revenue potential of affordable housing units, versus market-rate housing units.
- *§160D-1316* requires that conveyed property must contain covenants or conditions to ensure the property will be developed for lease to low to moderate income persons.
- At least 20 percent of rental units should be made available to households earning up to 60 percent area median income (AMI) for the Raleigh Metropolitan Statistical Area (MSA), as defined by the U.S. Department for Housing and Community Development (HUD).
- *§160A-279* requires that if a conveyance of land, by the local government, for under fair market value is made to a non-profit, the property must revert back to the local government when it is no longer used by the nonprofit for the purpose of providing affordable housing.

Selling Land for the Creation of Ownership Units

- Under state law *§160D-1316 Low- and moderate-income housing programs* and §*160A-279, Sale of property to entities carrying out a public purpose; procedure*, local governments may sell land for the purpose of building affordable housing, but the price of the land must reflect fair market value, unless the buyer is a non-profit entity. Fair market value appraisal may take into account the reduced revenue potential of affordable housing units, versus market-rate housing units.
- *§160D-1316* requires that conveyed property must contain covenants or conditions to ensure the property will be developed for sale only to low to moderate income persons.
- At least 20 percent of ownership units should be made available to households earning up to 80 percent area median income (AMI) for the Raleigh Metropolitan Statistical Area (MSA), as defined by the U.S. Department for Housing and Community Development

(HUD), and should have sale prices that do not exceed the State's Community Home Buying Programs' maximum sale prices. https://www.nchfa.com/home-buyers/community-home-buying-programs.

- *§160A-279* requires that if a conveyance of land, by the local government, for under fair market value is made to a non-profit, the property must revert back to the local government when it is no longer used by the nonprofit for the purpose of providing affordable housing.

IV. Neighborhood-Serving Uses

Mixed-use developments with active, ground-level uses are a high priority for the Town in Downtown Wake Forest and designated Transit-Oriented Development zones *(See Wake Forest Unified Development Ordinance and Zoning Map for specific geographical boundaries)*. As such, any proposal within these areas should strive to include at least a 1,000 square foot non-residential use that serves the surrounding neighborhood. Though a retail or service use is preferred, dedicated non-profit space may be considered if said use benefits low-to-moderate income households.

V. Design Standards

All proposals should adhere to the development standards of the Town's Unified Development Ordinance (UDO) and Manual of Specifications, Standards & Design (MSSD).

Additionally, if not expressed within the Town's development regulations, proposals involving infill development within existing neighborhoods should be considerate of surrounding context and architecture. Primary structures should orient towards streetscapes and open spaces with vehicle storage areas placed to the side or rear. Landscaping and outdoor amenities should be robust and easy to maintain.

For single-family detached and attached structures, the inclusion of porches or stoops is preferred. Exterior facade accents, such as brick or stone veneer, should wrap around corners no less than one foot in length. Building materials, such as siding or roofing shingles, should be of high quality with durability in mind.

VI. Content and Format of Proposal Package

Firms submitting proposals shall have no association with elected or appointed officials that could be considered a conflict of interest. Any such relationship will subject the firm to immediate disqualification in consideration for this project. A selection committee will evaluate the submittals and may elect to select the most desirable firm based on the responses as submitted or elect to conduct interviews with multiple firms prior to recommending a firm.

The submission shall be a maximum 20 pages front and back or 40 pages single-sided. Only digital Work Samples, which are excluded from the page limit, will be accepted. Submittals shall include the following:

Letter of Interest:

The letter of interest provided in the submission shall include the following:

- The name and address of the prime firm and the state in which it is incorporated and chiefly located.
- The name and address of each sub-firm and the state in which each entity is incorporated and chiefly located, if sub-firm is part of team.
- A brief description of the proposer (prime and sub-firm, if applicable), and its interest in developing the proposed site(s).
- The name, address, phone, and e-mail address of the designated contact for the proposer (prime firm).
- A statement indicating any judgments against the proposer (prime firm, sub-firms, and third-party firms) within the last five (5) years, or pending litigation, related to development activity, professional conduct or services.
- Acknowledgement of all addenda to the RFP document, if applicable.
- Signature of a duly authorized official of the prime firm or other person fully authorized to act on behalf of the firm or team.

Firm and Staff Qualifications:

The submission shall include a general description of the firm and its background as it relates to this project. Specific information regarding the firm and staff shall be submitted and include:

- Information regarding the firm's previous experience with similar or related projects, performed within the last 5 years, including a brief description of these projects and project staffing.
- Information on the firm's (including sub-firms, if applicable) previous experience successfully producing affordable housing.
- Information demonstrating the firm and staff capabilities to perform all aspects of this project, including financial capacity with financial institution references, if requested.
- Information regarding the expertise and experience of staff person(s) assigned to work on the project. It should also contain specific proposed responsibilities of the project staff person(s).
- A description and organizational chart showing the structure of the proposer's team, inter-relationships, areas of responsibility and the names and current professional licenses of key personnel assigned to the project along with their areas of responsibility. Note: no substitutions to the proposed project team of the selected firm(s) can be made without the prior written approval of the Town.
- The firm and staff qualification information for each sub-firm, a description of the services the firm performed, as well as related projects and references, if sub-firm is part of team.
- Three references including name, address, contact person, telephone number, email, project start and end date as well as a project description. References should be for similar or related projects on which key staff that are proposed for this project have worked.

Project Approach:

The submission shall provide a comprehensive narrative demonstrating the firm's understanding and approach to accomplishing the items listed in Sections II through V of this RFP document.

Pro Forma:

The submission shall provide a financial feasibility model in the form of a development pro forma.

Anticipated Schedule:

The submission shall include an anticipated schedule with the timeframe for each task incorporated. The submission shall demonstrate how the submitting firm will manage its responsibilities and work scheduled to be performed, including work of and with Town personnel.

Concept Design:

The submission shall include a concept design that, at a minimum, illustrates the arrangement and height of buildings, site ingress and egress, streets and driveways, sidewalks and pathways, and vehicle storage areas.

Though detailed architectural elevations are not necessarily an expectation, housing product samples should be provided to offer a sense of proposed architectural style and massing.

Project Samples:

The submission shall include three recent project samples related to housing development experience. Alternatively, if proposer is a newly formed partnership or firm, three project samples on which key staff that are proposed for this project have worked may be accepted.

VII. Submittal Process Details

Firm selection will be based on content, completeness, and presentation of information contained within the submittal package, consisting of the letter of interest, firm (prime and sub-firms) and staff qualifications and relevant experience, project approach, anticipated schedule, and project samples related to producing affordable housing as detailed in the Evaluation Criteria section of this RFP.

The Town of Wake Forest reserves the right to reject any responses to this RFP that do not comply with the content and format of proposal requirements. The Town can also conduct discussions with any or all respondents. The Town accepts no financial responsibility for any costs or expenses incurred by any entity in responding to this RFP. All submissions may be kept by the Town and may be disclosed to third parties at the Town's discretion.

VIII. Questions and Clarifications

All questions shall be submitted to Brad West, Long Range Planning Manager, via email (bwest@wakeforestnc.gov), no later than 2:00 p.m. on Friday, January 26, 2024. Questions submitted later than this deadline will not be considered. An addendum with questions and answers, if necessary, will be published on the Town website by 5:00 p.m. on Friday, February 2, 2024.

IX. Proposal Submittal

The deadline for firms submitting proposals is 2:00 p.m. on Friday, April 19, 2024. No submissions or supporting documents will be accepted after this deadline. Submittals may be emailed to bwest@wakeforestnc.gov or delivered to:

Physical Acceptance Location
Town of Wake Forest Town Hall
Attn: Brad West, Long Range Planning Manager
301 South Brooks Street, Ground Floor
Wake Forest, NC 27587-2901

Mailing Address
Town of Wake Forest Town Hall
Attn: Brad West, Long Range Planning Manager
301 South Brooks Street
Wake Forest, NC 27587-2901

Submittal packages should be enclosed in a sealed envelope marked **REQUEST FOR PROPOSALS – PURCHASE AND DEVELOPMENT OF TOWN OF WAKE FOREST PROPERTY** to the attention of Brad West, Long Range Planning Manager. All proposal packages and materials submitted hereunder become the exclusive property of the Town of Wake Forest.

X. Anticipated Schedule

- 01/29/2024: Questions and clarifications deadline
- 02/02/2024: Questions and clarifications response
- 04/19/2024: Submission deadline
- 04/22/2024 – 05/17/2024 Selection committee review of submittals
- 05/20/2024 – 05/31/2024: Virtual interviews conducted with selected firms, if necessary
- 06/03/2024: Highest ranked firm(s) notified
- 07/02/2024: Proposals presented to Board of Commissioners
- 07/16/2024: Board of Commissioners proposal selection
- 07/17/2024: Contract and sale/lease negotiation commences

XI. Selection Process

This RFP provides information necessary to prepare and submit proposals for consideration and ranking by the Town. It is the intent of the Town to appoint a selection committee to review the submitted proposals. This committee will review each proposal submittal and rank the submittal based on the criteria requirements specified within this RFP. The Town may invite firms for interviews, but this is not a required step in the selection process. At the conclusion of the interviews (if held), the selection committee will rank the proposals, and their respective firm(s), based on the selection criteria and the interviews. The Town will provide written notification to all firms regarding final selection by July 22, 2024.

Upon completion of the selection process, the top three highest ranked proposals will be brought forward to the Board of Commissioners for consideration. Upon selection by the Board of Commissioners, Town staff will begin contract and sale/lease negotiations with the selected firm. By submitting their proposal in response to this RFP, respondent accepts the evaluation process as outlined in the following section, acknowledges, and accepts that determination of the "highest ranked proposal" may require subjective judgments by the Town.

XII. Evaluation Criteria

1. Qualifications of the Firm: Outline and specify the qualifications of the firm to deliver affordable housing units as outlined in Section II Development Objectives, including track record, financial institution references, and financial capacity. This shall include any sub-firms that may be part of the team, if applicable. (20%)

2. Income Targeting and Mix: Specify the number of units and their respective level of affordability in relation to area median income (AMI) as determined by the U.S. Department for Housing and Community Development (HUD). Further, demonstrate ability to provide the units at the specified level of affordability, including information and assumptions about additional funding sources from grants, loans, etc. Provide a working excel cash flow model. (25%)

3. Duration of Affordability: Specify the duration of time affordable units will stay affordable, how this will be accomplished, and how affordable units could be monitored for compliance. (20%)

4. Concept Design. Provide a concept that illustrates the arrangement and height of buildings, site ingress and egress, streets and driveways, sidewalks and pathways, vehicle storage areas, and supplementary housing product samples. (20%)

5. Relevant Experience. Demonstrate relevant work experience with developing housing in comparable communities with references. (15%)

XIII. Developer Responsibility

The successful developer will be responsible for securing construction financing, completing all necessary site planning, any infrastructure necessary (including, but not limited to, installation of water and sewer taps, storm drainage, etc.) constructing the development, marketing, selling or renting all housing units to qualified households within 36 months of the date of closing. The developer is required to provide a construction schedule clearly outlining the sequence of activities with the resources necessary to complete the project in the most efficient time. This schedule should include all land planning efforts necessary to ensure efficient development of the site.

APPENDIX A

I. General Terms and Conditions

- The selected firm will work directly with the Town of Wake Forest. The selected firm is to enter into a contract and development agreement with the Town, prior to any sale or lease of land, to ensure that all development activity reflects the firm's proposal. The selected firm will be responsible for providing engineers, technicians, and sub-contractors with the appropriate skills and qualifications to ensure compliance. The firm will be directly responsible for oversight of the project.

- The selected firm will be notified by the Town and will enter into contract and development agreement negotiations for the sale/lease and development of land.

II. Communication:

All communication of any nature with respect to this RFP shall be addressed to the project manager identified earlier in this RFP. The prospective firms and their staffs are prohibited from communicating with elected Town officials, Town staff, and any selection committee member regarding this RFP or submittals from the time the RFP was released until the selection results are publicly announced. Violation of this provision many lead to disqualification of the firm's proposal for consideration.

III. Conflict of Interest Statement:

By submission of a response, the firm agrees that at the time of submittal, it: (1) has no interest (including financial benefit, commission, finder's fee, or any other remuneration) and shall not acquire any interest, either direct or indirect, that would conflict in any manner or degree with the performance of firm's services, and (2) will not benefit from an award resulting in a "Conflict of Interest." A "Conflict of Interest" shall include holding or retaining membership, or employment, on a board, elected office, department, division or bureau, or committee sanctioned by and/or governed by the Town. Firms shall identify any interests, and the individuals involved, on separate paper with the response and shall understand that the Town, in consultation with legal counsel, may reject their proposal.

IV. Changes to Firm Representation:

Changes to firm representation during contract and development agreement negotiations, are to be avoided wherever possible. The selected firm must notify the Town in writing for all changes to firm representation. The Town will consider notifications to change in representation and withholds the right to deem the selected firm no longer eligible for implementation of this RFP.

V. Trade Secrets and Public Records:

Records received by the Town in response to the Request for Proposals are public records and subject to public inspection and copying. The Public Records law (N.C.G.S. 132-1 et seq.) authorizes the Town to withhold from public inspection and copying legitimate and properly marked 'trade secrets'. Note that to protect a 'trade secret' detail requirements must be met, such as:

- It is a "trade secret" as defined in G.S. 66-152(3); and
- It is the property of a private "person" as defined in G.S. 66-152(2); and
- It is disclosed or furnished to the Town in connection with a bid or proposal; and
- It is marked as "confidential" or as a "trade secret" at the time of its initial disclosure to the Town.

VI. Submittal Ownership/Costs:

All responses, inquiries or correspondence relating to this Request for Proposals will become property of the Town of Wake Forest when received. Drawings, tracings, specifications, reports, models, computer discs, renderings, copyrights, and all other documents to be prepared and furnished by the firm pursuant to specific projects undertaken by the successful proposer, are the sole property of the Town of Wake Forest, whether the project for which they are made is executed or not, and may be used by the Town of Wake Forest as they see fit. If such documents are used on another project or for another purpose by the Town of Wake Forest, the firm shall not be responsible for such use, and shall not receive additional compensation. All costs for development of the written submittal and the oral presentation are entirely the obligation of the firm and shall not be remunerated in any manner by the Town of Wake Forest.

VII. Non-Warranty of Request for Proposals:

Due care and diligence has been used in preparing this RFP. However, the Town shall not be responsible for any error or omission in this RFP, nor for the failure on the part of the firms to ensure that they have all information necessary to effect their submittals.

VIII. Acceptance/Rejection of Submittals:

The Town of Wake Forest reserves the right to accept or reject any or all submittals in whole or in part, with or without cause; to waive technicalities; or to accept submittals or portions thereof which, in the Town's judgment, best serve the interest of the Town.

IX. Equal Opportunity:

The selected firm will ensure that employees and applicants for employment are not unfairly discriminated against because of their race, color, religion, sex, national origin, disability or veteran status.

X. Americans with Disabilities Act (ADA) Compliance:

The Town of Wake Forest will comply with the Americans with Disabilities Act (ADA) which prohibits discrimination on the basis of a disability. The Town of Wake Forest will make reasonable accommodations in all programs to enable participation by an individual with a disability who meets essential eligibility requirements. Town of Wake Forest programs will be available in the most integrated setting for each individual. If any accommodations are necessary for participation in any program or services, participants are encouraged to notify Town staff.

XI. Minority/Women/Small Business Enterprise:

It shall be the practice of the Town of Wake Forest Government to provide minority-owned, women-owned, and small business enterprises (collectively "M/W/SBE) as well as other responsible vendors with fair and reasonable opportunity to participate in Town of Wake Forest's business opportunities including but not limited to employment, construction development projects, and material/services, consistent with the laws of the State of North Carolina. The policy of the Town of Wake Forest prohibits discrimination against any person or business in pursuit of these opportunities on the basis of race, color, national origin, religion, sex, age, disability, or veteran's status. It is further the policy of the Town of Wake Forest to conduct its contracting and procurement programs so as to prevent such discrimination and to resolve any and all claims of such discrimination.

XII. Title VI:

The selected firm, during the implementation of this proposal for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

(1) Compliance with Regulations: The contractor shall comply with the Regulation relative to nondiscrimination in Federally-assisted programs of the Town of Wake Forest (hereinafter, "Town") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

(2) Nondiscrimination: The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, national origin, sex, religion, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when a contract covers a program set forth in Appendix B of the Regulations.

(3) Solicitations for Subcontractors, Including Procurements of Materials and Equipment: In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's

obligations under a contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

(4) Information and Reports: The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Town to be pertinent to ascertain compliance with such Regulations, orders, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor shall so certify to the Town as appropriate and shall set forth what efforts it has made to obtain the information.

(5) Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of a contract, the Town shall impose such contract sanctions as it or the Town may determine to be appropriate, including, but not limited to:

(a) withholding of payments to the contractor under a contract until the contractor complies, and/or
(b) cancellation, termination, or suspension of a contract, in whole or in part.

(6) Incorporation of Provisions: The contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the Town may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the Town to enter into such litigation to protect the interests of the Town, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

XIII. Financial Capacity:

The selected firm must have financial capacity to undertake the work and assume associated liability.

XIV. Familiarity and Compliance with Laws, Regulations, and Ordinances:

The selected firm shall make itself aware of and comply with and shall cause each of its subcontractors to comply with, all applicable federal, state, and local laws and regulations.

XV. Iran Divestment Act:

The selected firm shall certify that; (i) it is not identified on the Final Divestment List or any other list of prohibited investments created by the NC State Treasurer pursuant to N.C.G.S. 143-6A-4; (ii)

it will not take any action causing it to appear on any such list during the term of a contract, and (iii) it will not utilize any subcontractor to provide goods or services hereunder that is identified on any list.

XVI. Divestment from Companies that Boycott Israel:

The selected firm shall certify that; (i) it is not identified on the Final Divestment List or any other list of prohibited investments created by the NC State Treasurer pursuant to N.C.G.S. 143-6A-4; (ii) it will not take any action causing it to appear on any such list during the term of a contract, and (iii) it will not utilize any subcontractor to provide goods or services hereunder that is identified on any list.

XVII. Notifications

Addenda Notice:
It is the respondent's responsibility to ensure that all addenda have been received. Please visit https://www.wakeforestnc.gov/finance/purchasing-warehouse/bids-announcements for the most current information.

RESOLUTION 2023-XX

RESOLUTION TO AUTHORIZE THE TOWN MANAGER TO ESTABLISH AN AFFORDABLE HOUSING LAND DISPOSITION PROGRAM

WHEREAS, the Town of Wake Forest has grown significantly in recent decades; and

WHEREAS, new growth has provided numerous benefits to the Town, along with some complex challenges; and

WHEREAS, many find it difficult to maintain, purchase or rent a home in recent years due to surging housing costs; and

WHEREAS, to help mitigate the challenge of housing affordability, the Town of Wake Forest Board of Commissioners adopted the Housing Affordability Plan in 2022 ; and

WHEREAS, the Housing Affordability Plan called for the creation of a Land Disposition Program, which would organize the Town's process of selling or acquiring land for the purpose of creating affordable housing; and

WHEREAS, Town staff, working with housing consultants BAE Economics, produced the policy framework for a Town Land Disposition Program for affordable housing; and

WHEREAS, Town staff would utilize this policy framework to establish a Town of Wake Forest Land Disposition Program to sell or acquire land for affordable housing, including the allocation of necessary funding and staff time;

BE IT RESOLVED that the governing body of the Town of Wake Forest hereby authorizes the Town Manager to establish a Land Disposition Program for affordable housing based on the policy framework provided by Town staff.

Adopted and effective this 19th day of December 2023.

_____

Vivian A. Jones

Mayor

ATTEST:

_____

Theresa Savary

Town Clerk

APPROVED AS TO FORM:

_____

Hassan Kingsberry

Town Attorney

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-304-
Submitted by: Aileen J. Staples
Submitting Department: Finance
Meeting Date: December 19, 2023

SUBJECT
Approval of resolution updating the Internal Control Policy

Recommendation:
Approval as submitted

Item Summary:

ATTACHMENTS

- Internal Control Policy update _summary.pdf
- Internal Control Policy - TOWF_ update December 2023.pdf
- resolution 2023 - Internal Control Policy update.docx

Approval of resolution updating the Internal Control Policy

Summary: The Town originally adopted an internal control policy in October 2008 and was updated in 2016. This policy formalizes and documents operational procedures that protect and safeguards the town's assets. The updated policy reflects recent reorganization effective July 1, 2023, accounts for additional staffing and changes in technology.

Attachments: Resolution; Updated Policy

 **Town of Wake Forest**	**Revised: December 19, 2023** **Internal Control Policy** **Revised by:** Aileen Staples, Assistant Town Manager/CFO and Samantha Sanchez, Finance Director **Approved by:** Kip Padgett, Town Manager

Purpose: To document how the management of the Town of Wake Forest has fulfilled their responsibility for implementing and maintaining a sound and comprehensive framework of internal control. Internal controls are vital for identifying and addressing major performance and management challenges and areas at greatest risk of fraud, waste, abuse, and mismanagement.

Definition: Internal Control is a process which is designed by an entity's management to provide reasonable, but not absolute, assurance regarding the achievement of organizational objectives in the categories of: (1) reliability of financial reporting; (2) effectiveness and efficiency of operations; and (3) compliance with applicable laws and regulations.

Components of Internal Control: Understanding of the five components of the process is vital to properly structuring, implementing, and maintaining cost-effective internal controls.

1. ***Control environment*** provides the cultural atmosphere for human behavior within an organization. Several key factors expected of management include:
    a. *Integrity and ethical* values of managers and staff. Management plays a key role in providing standards of behavior, removing temptations for unethical behavior, and providing discipline when required.
    b. *Commitment to competence* so that all personnel receive the training, counseling, and performance evaluations required to perform their duties and understand the importance of maintaining good internal controls.
    c. *Management's philosophy and operating style* will impact the amount of risk tolerated and what behavior is rewarded or disciplined.
    d. *Organizational structure* impacts how internal control functions are communicated, respected, and reported.

e. *Assignment of authority and responsibilities* for operations and control functions establishes accountability for results.
f. *Human resource policies and practices* impact the control environment by establishing proper hiring, on-boarding, training, evaluating, counseling, promoting, compensating, and disciplinary guidelines.

2. *Risk Assessment* is necessary after management establishes certain objectives to anticipate and compensate for factors which may prevent management from fulfilling their responsibilities and goals.
3. *Control activities* are those procedures, actions, or activities that help ensure that management's directives are carried out. They may consist of policies, physical actions, software processes, or procedures such as segregation of duties.
4. *Information and communication* of internal control features focus on the entity's human and technological systems to ensure that the right information is presented to the right individuals at the right time and in the right format.
5. *Monitoring* internal controls on an ongoing basis is essential to make sure they are functioning as intended, and if not, for effective corrective action to be taken.

Limitations of Internal Controls. In this imperfect world, there are several factors which can reduce the effectiveness of internal controls.

1. *Cost-effectiveness.* The cost of a control in dollars or staff time should not outweigh the potential benefit.
2. *Management override* can easily circumvent control procedures, whether for expediency or personal benefit.
3. *Unexpected incidents* such as employee errors, mistakes in judgment, carelessness, or misunderstanding of instructions can be impediments.
4. *Collusion* is the intentional act of two or more employees to circumvent existing controls. This is usually hard to detect, and the difficulty increases with the authority level of the employee.

Management Objectives. The purpose of internal controls is to help ensure the following management objectives are met:

1. *Safeguarding Assets.* The Town of Wake Forest is responsible for prudent stewardship of cash and all items acquired with public funds including infrastructure, buildings, software, equipment, supplies, and for protecting other intangible items necessary for business functioning such as employee information.

2. ***Integrity of financial information***. Financial information is accurate, complete, properly authorized, and produced in a timely manner.
3. ***Compliance with laws and regulations.*** The Town of Wake Forest's financial operation complies with all state and federal requirements, current Generally Accepted Accounting Principles and (GAAP) and the Local Government Budget and Fiscal Control Act, all provisions of installment financing obligations, and any applicable grant or other funding source.
4. ***System promotes operational efficiency.*** Controls are cost-effective and easy to maintain working as intended according to approved policy.

Town of Wake Forest Internal Controls in Place

1. ***Control Environment***
    a. Keeping core values of trust, honesty, integrity, and accountability at the heart of management decisions and personnel evaluations
    b. Hiring qualified financial personnel and providing continuing training and educational opportunities and encouraging appropriate certifications
    c. Conducting an annual audit by well-qualified external CPA firm
    d. Requiring responsible employee authorization for all accounting transactions

2. *Risk Assessment and Control Activities*

Area	Risk	Control Procedures
Cash	Employee could pocket cash received from customers	• Separate functions of receiving payments, making bank deposit, and posting payments ***from*** bank reconciliation, customer invoicing and authorizing write-offs to customer accounts • Security cameras in place • Post payments in automated system at time of payment and provide system generated receipt to customer. • Review system reports for consecutive receipt numbers • Review any voided receipts and verify/audit reason for void

Area	Risk	Control Procedures
Cash	Employee could pocket cash using false invoice	• Separate functions of requisitioning, ordering, receiving, and approving invoices • Invoices are system generated and access is secured by user ids and type of user. • Review any voided invoices and verify/audit reason for void. • Invoices reviewed during accounts receivable and accounts payable process by the Finance Director
Cash	Employee could pocket cash from petty cash box	• Petty cash custodian has locked box and original receipts must be signed by employee receiving cash and approved by respective Supervisor and/or Department Director. • Reconciliation to replenish the petty cash fund conducted by Accountant. • Periodic audit by accounting staff (Financial Analyst or Accountant)
Cash	Criminals could try to steal cash by altering or counterfeiting TOWF check	• Daily verification of checks presented to the bank against TOWF records in bank reconciliation module. • Positive pay protection with bank • Monthly bank reconciliation – review of cleared checks
Cash	Criminals could try to steal cash by forging ACH draft	• Daily verification of ACH transactions processed by the bank against TOWF records in bank reconciliation module. • ACH positive pay protection with the bank

Area	Risk	Control Procedures
Cash	Employee could try to steal cash using blank check	• Check stock locked in fireproof cabinet – *finance vault.* • Check stock is blank and sequentially numbered on back (control numbers) • System generates next sequential check number. • Accountant and/or Finance Director verifies beginning and ending control and check numbers at the time checks are printed. • Void checks are reviewed and documented by accounting staff. • Signatures are digitized and built into software module within the financial server. Access to the server is secured by IT staff and password protected.
Cash	Cash transaction could be recorded improperly, such as typo error or NSF check notification not received from bank	• Daily verification of checks and ACH transactions processed by the bank against TOWF records in bank reconciliation module. • Positive pay protection with bank • Employee who does not record any cash transactions performs daily and monthly bank reconciliations. • All transactions are approved by the Finance Director or CFO prior to posting
Investments	Investment could be susceptible to theft	• Have contractual arrangement with third-party financially reputable custodial company to take delivery of investment before funds released to seller. • Internal reconciliation of purchase and sale confirmations on

Area	Risk	Control Procedures
		monthly statement from custodian by employee other than those who authorize and execute transactions
Investments	Investments and/or related income could be improperly recorded	• Compare financial records with statements prepared by custodian. • Accounting staff complying with GASB guidance
Investments	Investments not allowed under NC law could be purchased	• Adopted Investment Policy (included in fiscal policies) clearly identifying allowable investments. • Authorization and execution of trades separated duties. • Periodic review of LGFCA NC GS 159 • Semi-annual report of investments to LGC
Revenues	Revenues could be improperly recorded or not received in their entirety	• Separated duties of billing and recording payments • Approval of all invoice transactions prior to posting in ledger • Daily bank deposits and recording revenue. • Monthly outstanding balance reports to responsible Departments • Monthly financial summary reports to Board of Commissioners • Monthly review and analysis of outstanding balances and reconciliation to sub-ledgers • Write-off authorization limited to Town Manager, Chief Financial

Area	Risk	Control Procedures
		Officer (CFO) and Finance Director
Debt	Debt could be issued improperly	• All debt authorized by Board of Commissioners under auspices of LGC (if required)
Debt	Debt service could be under-paid or inadvertently missed	• Annual schedule of debt service corroborated with LGC and Trustee • Trustee notifies CFO and/or Finance Director if sufficient funding is not remitted. • Monthly monitoring of budget to actual results
Debt	Outstanding debt could be misreported in financial statements	• Annual schedule of debt service corroborated with LGC and Trustee • Accounting staff aware of disclosure checklists and requirements • Monthly monitor budget to actual results
Debt	Violation of debt covenants	• Management aware of provisions of financing agreements

Area	Risk	Control Procedures
		• Allowable ratio computed annually and included in notes to financial statements. • Annual review of provisions to ensure that there were no violations
Expenditures	Unauthorized or unavailable funds could be expended	• Board-approved budget entered accounting software. • Encumbrance module automatically prevents encumbrance if funds unavailable in line item. • Invoices must be approved for payment by authorized Department Director/or designee and respective Finance department designee. • All AP transactions in batch are reviewed and approved prior to posting in the accounting software. • Approval of accounts payable transactions is driven by security level in accounting system. • Purchase Order required for expenditures greater than $2,500. • Contracts are pre-audited by CFO, Finance Director, and/or and Purchasing Manager • Monthly review by CFO and/or Budget Manager of budget to actual expenditures by department and line item
Expenditures	Incorrect amounts could be recorded, or correct amounts omitted	• Open PO report distributed quarterly to Department Directors to obtain authorization to close or liquidate Purchase Orders with open balances.

Area	Risk	Control Procedures
		• Department Directors receive monthly budget-to-actual expenditure reports and detail transaction reports. • AP transactions are *reviewed and* approved prior to posting in the accounting software. • Approval of accounts payable transactions is driven by security level in accounting system. • Monthly review by Finance Director and Budget Manager of budget to actual expenditures by department and line item
Capital Assets	Capital Assets purchased could be incorrectly omitted from financial records	• Open PO report distributed quarterly to Department Directors to obtain authorization to close or liquidate Purchase Orders with open balances. • Department Directors receive monthly budget-to-actual expenditure reports and detail transaction reports. • AP transactions are approved prior to posting in the accounting software. • Finance Director, Financial Analyst and/or Accountant along with external auditors carefully examine expenditures posted to repairs & maintenance account and other large expenditures over $5,000. • Physical inventories taken every other year with unique asset identifier reconciling GL with subsidiary fixed asset module.

Area	Risk	Control Procedures
		• Finance reviews quarterly capital asset and updates accounting module
Capital Assets	Capital assets no longer in service inadvertently left on financial records and/or impairment not properly disclosed	• Physical inventories every 3 to 5 years with departmental staff • Annual review of capital asset records in software against automobile and property insurance schedules
Capital Assets	Assets could be lost due to theft, employee error or casualty	• Adequate property and liability coverage maintained. • Buildings and storage areas locked after hours. • Physical inventories every 3 to 5 years with departmental staff • Security systems and cameras installed at various locations. • Inventory listing of items less than capital asset threshold is maintained by various departments
Inventory	Items could be stolen or removed from storage and not properly recorded	• Buyer/Inventory Clerks record reductions in inventory through issue ticket process • Issue tickets approved by Purchasing Manager before posting in system. • Purchasing Manager or designee releases items • Storage area locked during absence of warehouse staff. • Purchasing staff performs annual inventory counts. • Discrepancies between ledger and actual inventory amounts are investigated

Area	Risk	Control Procedures
Inventory	Items purchased not properly recorded in perpetual inventory system	• Item numbers used on PO carry through in software module when recording receipt of items. • Invoices approved by Purchasing Manager (or designee) and Finance Director prior to posting in accounting software. • Purchasing Manager and staff performs inventory counts annually. • Discrepancies between ledger and actual inventory amounts are investigated
Inventory	Value of items not properly recorded in financial statements	• Invoices approved by Purchasing Manager (or designee) and Finance Director prior to posting in accounting software. • Purchasing and Warehouse staff conduct annual physical inventory counts. Discrepancies between ledger and actual inventory amounts are investigated. • Annual inventory identifies obsolete or damaged items
Purchasing	Possible violation of state procurement laws	• Purchasing staff attend continuing education. • Adopted Purchasing policy and P-card policies in place. • Policy and procedure manual incorporates legal mandates. • Annual review of purchasing limits and delegations of authority to purchase and contract with Department Director

Area	Risk	Control Procedures
Purchasing	Risk of not getting best value for taxpayer dollars	• Follow formal and informal bid procedures in policy based on state law and best practices. • Frequent RFPs and bidding for repeat or continuing contracts • Use Cooperative Purchasing groups and discount programs such as U.S. Communities as well as State Contract
Payroll	Pay persons who are not town employees	• New hire and termination forms are authorized by Human Resources, CFO and Town Manager (or designee) prior to receipt by Payroll. • Timesheet submission required for all employees. • Everyone's time sheet per pay cycle approved by respective Departmental Supervisor prior to posting. • Budget to actual monthly expense report to Department Directors • Monthly review of budget to actual expenditures by Budget division • Email notification received from Human Resources when employees separate from the town
Payroll	Amounts paid and/or deducted are incorrect	• Payroll file is maintained to document current pay rates and all deductions. • Payroll Audit Checklist utilized to verify expected to actual pay, benefits, and deductions for each pay run. • Periodic audit of payroll file to verify rates and deductions.

Area	Risk	Control Procedures
		• Direct deposit information entered by employees in HR Portal

3. ***Monitoring Internal Controls.*** On a periodic basis, the CFO and/or Finance Director or designee will monitor the effectiveness of these controls and propose any modifications as indicated. Also, any malfunctioning of internal controls discovered by external auditors will be immediately investigated by the CFO or Finance Director and appropriate remedial action will be taken and documented.

4. ***Misuse of Town of Wake Forest Assets.*** Any employee who suspects or becomes aware of the misuse or potential misuse of Town of Wake Forest assets shall immediately notify the CFO and the Finance Director. If the CFO or the Finance Director is involved in the misuse or potential misuse, the employee shall immediately notify the Town Manager. The CFO, Finance Director and/or Town Manager (or designee), as appropriate, shall investigate and report to respective Department Director, Town Attorney and/or Human Resources if additional action is required.

Authority: North Carolina General Statutes 159-25(a)(1) charges the Finance Officer with keeping the books of the government "in accordance with generally accepted principles of governmental accounting and the rules and regulations of the [Local Government] Commission. Statements on Auditing Standards (SAS) Numbers 55, 94, and 112 provide authoritative guidance for establishing and managing internal controls, and the North Carolina State Treasurer's Manual prescribes internal control functions.

Reference Materials:

Miller 2002 GAAS Guide

Standards for Internal Control in the Federal Government issued by the United States General Accounting Office

Evaluating Internal Controls: A Local Government Manager's Guide by Stephen J. Gauthier, published by GFOA.

NC Department of State Treasurer Policies Manual—Internal Controls Chapter

GFOA Recommended Practice—Enhancing Management Involvement with Internal Control (2004)

RESOLUTION 2023 - xx

RESOLUTION APPROVING REVISED INTERNAL CONTROL POLICY THE TOWN OF WAKE FOREST, NORTH CAROLINA

WHEREAS the Town of Wake Forest adopted an internal control policy in October 2008 and updated in 2016; and

WHEREAS internal control is a process which is designed by an entity's management to provide reasonable, but not absolute assurance regarding the achievement of organizational objectives in the categories of 1) reliability of financial reporting; 2) effectiveness and efficiency of operations; and 3) compliance with applicable laws and regulations; and

WHEREAS the internal control policy documents how management has fulfilled their responsibility for implementing and maintaining a sound, comprehensive framework of internal control. Internal controls are vital for identifying and addressing major performance and management challenges along with areas at greatest risk of fraud, waste, abuse, and mismanagement.

NOW, THEREFORE BE IT RESOLVED, by the Board of Commissioners of the Town of Wake Forest, that the updated Internal Control Policy is hereby approved effective January 1, 2024.

This the 19th day of December 2023.

_____

Vivian A. Jones
Mayor

ATTEST:

_____

Theresa Savary
Town Clerk

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-331-
Submitted by: Nick Nolte
Submitting Department: Engineering
Meeting Date: December 19, 2023

SUBJECT
Second Vote to Consider the Stormwater Utility Fee

Recommendation:

Item Summary:

ATTACHMENTS

- Agenda Summary_121923.pdf
- Attachment A_Ordinance.docx
- Exhibit 1_Chapter 14_Article IV_V.docx

Agenda Item: Second Vote to Adopt the Stormwater Utility Fee

Summary: The Engineering Department along with the Stormwater Utility Advisory Group has proposed a new Stormwater Utility Fee. Chapter 14 Article V of the proposed ordinance lists a civil penalty; therefore, two votes are needed per Senate Bill 300. The Board of Commissioners held one vote at the November 21st, 2023, Board of Commissioners meeting and voted unanimously to approve the proposed ordinance. This is the second vote for the same ordinance per the requirement.

Attachments: Attachment A_Ordinance
Exhibit 1_Chapter 14_Article IV_V

ORDINANCE 2023-XXX

ORDINANCE OF THE BOARD OF COMMISSIONERS OF THE TOWN OF WAKE FOREST AMENDING THE WAKE FOREST CODE OF ORDINANCES TO ESTABLISH A STORMWATER UTILITY FEE

WHEREAS, the purpose of this amendment is to establish a stormwater utility fee; and

WHEREAS, a Stormwater Utility Advisory Group was created consisting of a Planning Board Member, a HOA Property manager, two large business representatives, an Engineer, an active resident, a Downtown Chamber of Commerce member, as well as a small business owner; and

WHEREAS, the Stormwater Utility Advisory Group met six (6) times to develop recommendations on the level of service, capital projects, fee basis and fee credits, residential and non-residential rate structures, and the assessment mechanism of the stormwater utility fee; and

WHEREAS, The Engineering Department and a representative from the Stormwater Utility Advisory Group presented the recommendations to the Board of Commissioners at the November 9th work session; and

WHEREAS, a newspaper notice publication was carried out for the public hearing pursuant to G.S. §160A-314; and

NOW, THEREFORE, BE IT ORDAINED by the Board of Commissioners of the Town of Wake Forest:

Section 1: Adopts the Article IV of Chapter 14 (Exhibit 1).

Section 2: Strikes Article VI of Chapter 32 in its entirety from the Code of Ordinances.

Section 3: Deems the amended Chapter 14 of the Code of Ordinances effective July 1st, 2024.

Adopted and effective this _____ day of _____ 2023.

_____
Vivian A. Jones
Mayor

ATTEST:

_____
Theresa Savary
Town Clerk

APPROVED AS TO FORM:

_____
Hassan Kingsberry
Town Attorney

ARTICLE IV. STORMWATER UTILITY

Sec. 14-75. Purpose.

A stormwater utility enterprise fund is hereby created as an identified fiscal and accounting fund for the purpose of comprehensively addressing the stormwater management program needs of the town. The town's stormwater management needs are met:

(1) Through programs designed to protect and manage water quality and quantity by controlling the level of pollutants in stormwater runoff and the quantity and rate of stormwater received and conveyed by structural and natural stormwater and drainage systems of all types;

(2) By establishing a schedule of charges;

(3) By defining the control, collection, and disbursement of funds; and

(4) By setting forth penalties, methods of appeals and exemptions.

The public enterprise shall be referred to as the Wake Forest Stormwater Utility.

Sec. 14-76. Authority.

This article is adopted pursuant to the authority granted to the town by G.S. 160A-314.

Sec. 14-77. Definitions.

Unless specifically defined below, words or phrases shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most effective application. Words used in singular shall include the plural and the plural of the singular; words used in the present tense shall include the future tense. The word "shall" denotes mandatory and not discretionary; the word "may" is permissive.

Customer. A person(s), property owner, or entity to which the stormwater utility fee is billed and/or receives a bill from town for other services provided by the town.

Customer, non-residential. A non-residential, including multifamily, industrial, commercial, retail, government, or non-profit organizations, property, or portion of property, containing impervious area.

Customer, residential. A non-commercial single-family use.

Developed property. Real property which has been altered from its natural state by the addition and attachment of any improvements such as buildings, structures, or other impervious surfaces.

Drainage. The flow of stormwater runoff into a conveyance.

Drainage system. Natural and structural channels, swales, ditches, swamps, rivers, streams, creeks, wetlands, branches, reservoirs, ponds, drainage ways, inlets, catch basins, gutters, pipes, culverts, bridges, head walls, storm sewers, lakes, and other physical works, properties, and improvements that transfer, control, convey or otherwise influence the movement of stormwater runoff.

Due notice. Notice given by posting where appropriate not less than 7 days before the date of the event of which the notice is being given.

Easement. A grant of rights by a property owner to a portion of land for a specified purpose as defined in a recorded deed, as delineated on a recorded plat, or as established in another legal document.

Equivalent residential unit (ERU). For the purposes of this chapter, means 1,200 square feet of impervious surface, which is the average amount of imperious surface within and/or on an average single-family property in the town.

Exemption. Not applying or removing the application of the stormwater utility fee service charge from a property. No permanent exemption shall be granted based on taxable or nontaxable status or economic status of the property owner.

Impervious area. The amount of impervious surface on a property.

Impervious surface. Includes any material which reduces and/or prevents absorption of storm water. This includes but is not limited to, buildings, roads, pavement, gravel surfaces, etc. Open bodies of water, a wooden slatted deck, or other material defined as pervious per the NCDEQ Minimum Design Criteria (MDC) are not considered impervious surfaces for the purpose of this article.

Improved property. Developed land that has 400 square feet or greater impervious surface. *National pollutant discharge elimination system (NPDES).* A permitting system established by Section 402 of the Clean Water Act et seq. Federal law reference: National Pollutant Discharge Elimination System Permits, 33 USC Section 1342. NPDES stormwater discharge permits are issued by the state under delegation from the EPA for discharges directly to the surface waters of the state pursuant to G.S. 143-215.1.

Non-residential developed land. All non-residential land uses including, but not limited to, churches, institutional buildings, whether public or private; hospitals, rest homes, public and private schools, colleges and universities, dormitories, commercial, retail, office, hotels and motels, industrial buildings, storage areas, and parking lots or other impervious surfaces.

Property owner or *owner*. The owner of a parcel of land as shown on the county tax records.

Revenues All fees, charges, penalties, or other income received by the stormwater utility program enterprise fund, including but not limited to amounts received from the investment or deposit of monies into any fund or account, and all amounts received as gifts or donations, and the proceeds from the sale of bonds to finance the stormwater utility, or any other type of funds derived from grants, fees or loans which by purpose or effect relate to stormwater management activities.

Stormwater. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation and resulting from such precipitation, regardless of amount of precipitation or time of precipitation event.

Stormwater utility The various methods employed by the town to manage stormwater and comply with its NPDES stormwater discharge permit.

Stormwater utility fee. The yearly monetary amount charged each parcel of real property for the services provided by the stormwater utility as set forth in the town schedule of rates and fees.

Undeveloped land. All land that is not altered from its natural state to an extent that results in 400 or more square feet of impervious surface area.

Sec. 14-78. Establishment of the stormwater utility enterprise fund.

The Board of Commissioners (BOC) hereby establishes a town stormwater utility enterprise fund for the purpose of dedicating and protecting funding to carry out the responsibilities of the stormwater utility. This includes, but is not limited to, fees, charges, and penalties as may be established, after due notice and a public hearing for stormwater utility enterprise fund. Funding may also include other funds transferred or allocated to the stormwater utility enterprise fund by the BOC. All revenues and receipts of the stormwater utility shall be placed in the stormwater utility enterprise fund and the expenses of the stormwater utility shall be paid from the stormwater utility enterprise fund. This article shall apply to all property within the corporate limits of the Town of Wake Forest. The Town may use other budgeted funds that are not stormwater utility funds to provide stormwater services.

Sec. 14-79. Interpretation and administration of this article.

The Town Manager or their designee shall be responsible for the interpretation and administration of this article that includes, but is not limited to, the calculation of fees, adjustments, and other interpretations as necessary with the exception of billing and collection of fees as described in this article.

Sec. 14-80. Impervious surface and equivalent residential unit (ERU).

(a) Impervious surface area is an improvement on any part of land that prevents or significantly impedes the infiltration of stormwater into the soil. By way of example and not limitation, typical impervious surface areas include roofs, sidewalks, walkways, patios, private driveways, parking lots, access extensions, alleys and other paved, engineered, compacted or gravel surfaces containing materials that prevent or significantly impede the natural infiltration of stormwater into the soil.

(b) The amount of impervious surface area of real property is a key factor in the peak rate of stormwater runoff and the pollutant loadings of stormwater runoff discharged to the structural and natural drainage systems and facilities. Therefore, the amount of impervious surface area shall be the primary parameter for establishing the rate structure to distribute the cost of the program through a schedule of rates, fees, charges and/or penalties, to all Customers that own or occupy improved property.

(c)

(c) For the purposes of tracking improvements and modifications to impervious surface. The Town will evaluate impervious surface square footages by parcel every four (4) years.

Sec. 14-81. Stormwater utility fee schedule.

(a) The yearly charges for town stormwater utility fee services shall vary according to the residential tier or non-residential parcel impervious surface area and be incorporated into annual fee schedule. Each single-family residence will be sorted into a tier based on the amount of impervious area on the parcel. Non-residential parcels shall be billed according to the number of equivalent residential units (ERUs) present on the parcel, in whole increments, as determined by analysis of impervious surface.

(c) Other fees, charges and penalties may be adopted from time to time by the BOC incidental to the purposes of stormwater utility as provided in G.S. 160A-314.

(d) Tiers and rates shall be set annually by the Town Manager or designee in the amount to ensure that the total fees collected by the town through the stormwater utility fee do not exceed the cost of providing the stormwater utility.

Sec. 14-82. Stormwater utility fee billing and collection.

(a) Payment for stormwater utility fees, charges, and penalties are the obligation of the property owner and shall be billed on a yearly basis with the property tax bill.

(b) Bills for stormwater utility fee shall be sent at the same frequency as the yearly tax bill. Billing and collection of stormwater utility fees, charges, and penalties shall be administered in coordination with County Tax Administration and Wake Forest Finance Department. The Finance Department is hereby authorized to develop policies and procedures to effectuate the purpose, intent and billing needs of this section.

Sec. 14-83. Disposition and application of fees.

Stormwater utility fee and fee revenues shall be assigned and dedicated solely to the stormwater utility enterprise fund in the town budget and accounting system, which shall be and remain separate from other funds, and shall be used only to fund stormwater utility activities. The fees paid to and collected by the town by virtue of the provision of this article shall not be used for general or other governmental or proprietary purposes of the town, except to pay for costs incurred by the town in rendering services associated with the stormwater utility.

Sec. 14-84. Credits and exemptions.

Except as provided in this article, there shall be no exception, credit, offset, or other reduction in stormwater utility fees or service charges granted based upon age, race, tax status, economic status, or religion of the customer, or other condition unrelated to the stormwater utility's cost of providing stormwater program services and facilities, with the following exceptions:

(1) The Director of Engineering will consider the adoption of fee credits for development that meets or exceeds minimum qualifying criteria developed by the Town. The total amount of credit shall be recommended by the Director of Engineering, based upon review of the criteria.

(2) Improved public right of way and greenways.

(3) Properties and facilities owned and operated by the Town.

(4) Undeveloped land and properties with fewer than 400 square feet of impervious surface.

Sec. 14-85. Limitations of responsibility.

(a) The town shall be responsible only for the portions of the drainage system which are located within the corporate limits of the town, have been accepted by the town, and are actively maintained by the town. This includes street rights-of-way and permanent public storm drainage easements which have been conveyed to and accepted by the town.

(b) The town's acquisition of permanent storm drainage easements and/or the construction or repair by the town of drainage facilities does not constitute a warranty against stormwater hazards, including but not limited to flooding, erosion or standing water.

ARTICLE V. ILLICIT STORMWATER DISCHARGE

Sec. 14-86. Short title.

This article shall be known as the "Illicit Stormwater Discharge Ordinance for the Town of Wake Forest, North Carolina."

(Ord. No. 2003-45, 11-18-03)

Sec. 14-87. Definitions.

Unless specifically defined below, words or phrases shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most effective application. Words used in singular shall include the plural and the plural of the singular; words used in the present tense shall include the future tense. The word "shall" denotes mandatory and not discretionary; the word "may" is permissive.

Adverse impacts. Any modifications, alterations or effects on a feature or characteristic of community waters or wetlands, including their quality, quantity, hydrodynamics, surface area, species composition, living resources, aesthetics or usefulness for human or natural uses which are or may potentially be harmful.

Authorized enforcement agency. Employees or designees of the Town of Wake Forest.

Best management practices (BMPs). Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and education practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or storm water conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act. The federal Water Pollution Control Act (33 U.S.C. and 1251 et. seq.) And any subsequent amendments thereto.

Community of waters. See "Waters."

Connection. Any physical common joining including devices that are natural, constructed, installed, fabricated, shaped, redirected, sloped, pumped, drained connection including methods by artificial or natural means, and located either above surface, at surface, or sub-surface locations, and from either indoor, outside, and moveable sources of origination and including spills.

Construction activity. Activities subject to NPDES construction permits. These include construction permits resulting in land disturbance of one acre or more. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Drainage facility. Any component of the drainage system.

Drainage system. System through which water flows from the land, including piping, watercourses, water bodies, and wetlands.

Excluded stormwater system discharge category. The following categories or potential discharges to the stormwater system are not be considered:

(1) Water line flushing.

(2) Landscape and lawn irrigation water.

(3) Diverted stream flows.

(4) Rising ground waters.

(5) Uncontaminated ground water infiltration (as defined at 40 CPR 35.2005(20).

(6) Uncontaminated pumped ground water.

(7) Discharges from potable water source.

(8) Air conditioning condensation.

(9) Springs.

(10) Water from crawl space pumps.

(11) Individual residential car washing.

(12) Flows from riparian habitats and wetlands.

(13) De-chlorinated swimming pool discharges.

(14) Street wash water.

(15) Foundation or footing drains (not including active groundwater dewatering systems).

(16) Other water source discharge not containing pollutants.

(17) Discharges or flows from fire fighting activities only used to be addressed where they are identified as significant sources of pollutants.

Flood. Temporary rise in the level of any water body, watercourse or wetland which results in the inundation of areas not ordinarily covered by water.

Hazardous materials. Any material including any substances, waste or combination thereof, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illicit connection. Any unlawful connection, which allows the discharge of non-stormwater to the stormwater conveyance system or waters of the state in violation of this article, regardless of whether said conveyance system or connection had been previously allowed, permitted, or approved by the town or including whether any conveyance system or connection to the stormwater drain system which has not been documented in plans, map or equivalent records and approved by the town for a private, residential, commercial, industrial or public land use.

Illegal discharge. Any unlawful direct or indirect non-stormwater discharge, disposal, placement, emptying, dumping, spillage, leakage, pumping, pouring, emission, or other discharge of any substances other than stormwater into the municipal separate storm sewer system (MS4), that is not composed entirely of stormwater and, except discharges pursuant to a current NPDES permit, discharges resulting from fire fighting activities, and excluded discharge categories, such that the substance is likely to reach a stormwater conveyance or the waters of the state. These illicit stormwater discharges may include earth, fluid, solid, gas, or other substances, other than stormwater, provided that non-stormwater discharges associated with an excluded stormwater system discharge category may significantly impact water quality.

Industrial activity. Activities subject to NPDES industrial permits as defined in 40 CFR, section 122.23 (bX14).

MS4. Municipal separate storm sewer system.

Municipal separate storm sewer system. (MS4). A separate conveyance system, constructed or present, to convey stormwater drainage, separately from other wastes systems such as sewer systems, through the use of ditches, swales, pipes, culverts, over-land drainage, surface and subsurface flows.

National pollutant discharge elimination system (NPDES) stormwater discharge permit. A permit issued by EPA (or a state under authority delegated pursuant to 33 U.S.C. & 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Natural systems. Those communities of plants, animals, bacteria and other flora and fauna that occur indigenously on the land, in the soil or in the water.

Non-stormwater discharge. Any discharge to the stormwater drain system that is not composed entirely of stormwater.

NPDES Phase II Regulations. Federal register part II 40 CFR parts 9, 122, 123 and 124 the "National Pollutant Discharge System - Regulations for Revision of the Water Pollution Control Program Addressing Stormwater Discharge."

Person. Person means any and all persons, includes any individual, firm, corporation, government agency, business trust, estate, trust, partnership, association, two or more persons having a joint or common interest, or any other legal entity.

Pollutant. Anything that causes or contributes to pollution. Pollutants may include, but are not limited to paints, varnishes and solvents, oil and other automotive fluids, non-hazardous liquid and solid wastes and yard wastes, refuse, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations that may cause or contribute to pollution, floatables, pesticides, herbicides, and fertilizers, hazardous substances and wastes, sewage, fecal coliform and pathogens, dissolved and particulate metals, animal wastes, wastes and residues that result from constructing a building or structure, and noxious or offensive matter of any kind.

Premises. Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Receiving bodies of water. Water bodies, watercourses or wetlands into which surface waters flow either naturally, in manmade ditches, or in a closed conduit system.

Stormwater. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation and resulting from such precipitation, regardless of amount of precipitation or time of precipitation event.

Stormwater drainage system. Facilities by which stormwater is collected and/or conveyed including but not limited to any roads with drainage systems, streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and manmade or altered drainage channels, reservoirs, and other drainage structures.

Stormwater pollution prevention plan. A document which describes the best management practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to stormwater, stormwater conveyance systems, and/or receiving waters to the maximum extent practicable.

Wastewater. Means any water or other liquid, other than uncontaminated stormwater, discharged from a facility.

Water body. Natural or artificial pond, lake, reservoir or other area which ordinarily or intermittently contains water and which has a discernable shoreline.

Watercourse. Any natural or artificial stream, river, creek, channel, ditch, canal, conduit, culvert drain, waterway, gully, ravine, street, roadway, swale or wash in which water flows in a definite direction, either continuously or intermittently, and which has a definite channel, bed or banks.

Waters or community of waters. Water on or beneath the surface of the ground including watercourses, water body, or drainage system, including diffused surface water and water percolating, standing or flowing beneath the surface of the ground.

Waters of the state. Surface waters within or flowing through the boundaries of the state including any intermittent or perennial stream, river, creek, brook, swamp, lake, sound, tidal estuary bay, reservoir, wetland, or any other surface water or any portion thereof that is mapped as solid or dashed blue lines on United States Department of Interior Geological Survey 7.5 minute series topographic maps. Treatment systems, consisting of manmade bodies of water, which were not originally created in waters of the state and which are not the result of impoundment of waters of the state, are not waters of the state.

Wetlands. Those areas where:

(1) The soil is ordinarily saturated with water; or

(2) The dominant plant community is one or more of those species designated by the U. S. Army Corps of Engineers as identifying wetlands or the transitional zone of wetlands; or

(3) The presence of one or more of those plant species designated by the North Carolina Division of Coastal Management as identifying coastal wetlands or the transitional zone of coastal wetlands.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-88. Findings of facts.

The board of commissioners finds that the discharge of non-stormwater drainage to waters of the state and to the municipal storm drainage system could have significant adverse impact upon health, safety, and welfare of the community. More specifically:

(1) Illicit stormwater discharges carry pollutants into receiving water bodies, degrading water quality and effect in closures of shell fishing water.

(2) A nutrient such as phosphorus or nitrogen accelerates eutrophication of receiving waters, adversely affecting flora and fauna.

(3) Improper connection to the storm drain system and to waters of the state adversely impacts quality of receiving waters.

(4) Septic tank discharges from non-compliant systems, washing machine discharges, and illegal dumping into the stormwater drains are examples of illicit discharges.

(5) The town must have the authority to deter and/or stop illicit discharges to stormwater drains and ditches.

(6) Substantial economic losses result from these adverse impacts on community waters.

(7) Illicit discharges to water bodies diminish their capacity to naturally process runoff nutrients, thereby harming flora and fauna.

(8) Increase of illicit discharge to waters can percolate into the soil, thereby decreasing groundwater quality.

(9) Improperly managed stormwater systems can decrease the quality of property and human life.

(10) Improperly managed stormwater drainage systems can interfere with the maintenance of optimum estuarine areas and biological productivity.

(11) Many future problems can be avoided if land is developed in accordance with an illicit stormwater discharge ordinance.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-89. Objectives.

(a) The purpose of this article to provide for the health, safety, and general welfare of the people of the town through the regulation of non-stormwater discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This article establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process.

(b) In order to protect, maintain, and enhance both the immediate and the long-term health, safety and general welfare of the town, this article has the following objectives:

(1) To obtain the contribution of pollutants to the municipal separate storm sewer system (MS4) by stormwater discharges by any user.

(2) To prohibit illicit connections and discharges to the municipal separate storm sewer system (MS4).

(3) To establish legal authority to carry out all inspections, surveillances, and monitoring procedures necessary to ensure compliance with this article.

(4) To encourage productive and enjoyable harmony between humanity and nature.

(5) To protect and maintain the chemical, physical, and biological integrity of any and all waters.

(6) To prevent individuals and organizations from causing harm to the community by activities which adversely affect water resources.

(7) To encourage the maintenance and construction of drainage systems which aesthetically and functionally approximate natural systems.

(8) To encourage town occupants to be aware of potential sources of illicit discharges, so they can better manage their actions in the environment.

(9) To protect natural systems and their uses in ways that do not impair their beneficial functioning.

(10) To increase and maintain the quality of groundwater sources.

(11) To protect and maintain estuarine areas.

(12) To prevent damage to waters, including wetlands and groundwater systems.

(13) To protect and maintain fish and wildlife habitats.

(14) To ensure the attainment of these objectives by requiring the approval and implementation of the Illicit Stormwater Discharge Ordinance.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-90. Applicability.

(a) This article shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly excepted by the town, as an excluded discharge category.

(b) Stormwater discharge, occurring after the effective date of November 18, 2003, within the town, must comply with the Illicit Stormwater Discharge Ordinance. All persons must take appropriate actions and measures, as defined in this Illicit Stormwater Discharge Ordinance, and all other town ordinances, regulations and laws, to stop all illicit stormwater discharges that may occur on their property and, if necessary, ensure appropriate corrective measures are taken on any existing known, noted or observed non-compliant items including: discharges, connections, activities, or actions.

(c) All persons shall address present non-complying illicit stormwater discharges including the following possible occurrences:

(1) Connections to a stormwater conveyance or stormwater conveyance system, which allows the discharge of non-stormwater, other than excluded discharge category, are unlawful. Prohibited discharges include, but are not limited to:

a. Floor drains.

b. Waste water from washing machines.

c. Waste water from sanitary sewers.

d. Wash water from commercial vehicle washing or steam cleaning.

e. Connection of drainage leaders from structures.

f. Failed or failing wastewater disposal fields.

g. Illicit discharge resulting from household pet waste.

h. Illicit discharge resulting from lawn care products including excessive fertilizers, lawn/landscape chemical treatments.

i. Disposal of household hazardous pollutants.

j. Abandoned water wells.

(2) Where such connections exist and said connections were made prior to the adoption of this provision or any other ordinance prohibiting such connections, the property owner or the person using said connection shall remove the connection within one (1) year following application of this regulation.

(3) The one-year grace period shall not apply to connections which may result in the discharge of hazardous materials or other discharges which pose any immediate threat to health and safety; are likely to result in immediate injury and harm to real or personal property, natural resources, wildlife, or habitat; or were made in violation of any applicable regulation or ordinance.

(4) The town shall designate the time within which the connection shall be removed. In setting the time limit for compliance, the town shall take into consideration:

a. The quantity and complexity of the work.

b. The consequences of delay.

c. The potential harm to the environment, to the public health, and to public and private property; and

d. The cost of remedying the damage.

(5) Unless exempted pursuant to subsection (6) or granted a variance pursuant to subsection (6), a corrective plan must be submitted and corrected action to remedy an identified illicit stormwater discharge taken before:

a. A plat is recorded or land is subdivided; or

b. An existing drainage system is altered, rerouted, or deepened; or

c. A new building permit is issued.

(6) Exemptions: The following development activities are exempt from the Illicit Stormwater Discharge Ordinance Plan requirement.

a. Agricultural activity not involving the artificial drainage of land.

b. Variances. The town may grant a written variance from any requirement of this article using the following criteria:

1. There are special circumstances applicable to the subject property of its intended use; and

2. The granting of the variance will not:

(i) Significantly increase or decrease the rate of illicit stormwater discharge or pollutants.

(ii) Have a significant adverse impact on the area "404 wetland", watercourse or water body.

(iii) Significantly contribute to the degradation of water quality.

(iv) Otherwise significantly impair attainment of the objectives of this article.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-91. Responsibility for administration

The town shall administer, implement, and enforce the provisions of this article. Any powers granted or duties imposed upon the town may be delegated in writing to persons or entities acting in the beneficial interest of the town.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-92. Ultimate responsibility.

The standards set forth herein and promulgated pursuant to this article are minimum standards; therefore this article does not intend nor imply that compliance by any person will ensure that there will be no contamination, pollution, nor unauthorized discharge of pollutants.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-93. Watercourse protection.

Every person owning property through which a watercourse passes or such person's lessee, shall keep and maintain that part of the watercourse within the property free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a

watercourse so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-94. Requirements to prevent, control and reduce stormwater pollutants by the use of best management practices.

The town will adopt requirements identifying best management practices for any activity, operation, or property that may cause or contribute to pollution or contamination of stormwater, the stormwater drain system, or waters of the United States. The owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the stormwater drain system or watercourses through the use of these structural and non-structural BMPs. Further, any person responsible for a property or premise which is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the stormwater drain system. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of stormwater associated with industrial activity to the extent practicable, shall be deemed in compliance with the provisions of this section. These BMPs shall be part of a stormwater management plan as necessary for compliance with requirements of the NPDES permit.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-95. Permitted discharge activity.

Any person subject to an NPDES stormwater discharge permit (including construction activity, land disturbance permit, industrial NPDES permit or other NPDES Permit) shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the town prior to the allowing of discharges to the stormwater drain system.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-96. Discharge prohibitions.

(a) *Prohibition of illegal discharge.* No person shall discharge or cause to be discharged into the stormwater drain system or watercourses any materials, including but not limited to, pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than stormwater.

The commencement, conduct or continuance or any illegal discharge to the stormwater drain system is prohibited except as described as follows:

(1) The following discharges are exempt from discharge prohibitions established by this article.

a. Rising ground water.

b. Uncontaminated pumped ground water.

c. Foundation or footing drains (not including active groundwater dewatering systems).

d. Crawl space pumps.

e. Other water source not containing pollutants.

(2) Discharges specified in writing by the town as being necessary to protect public health and safety.

(3) Dye testing is an allowable discharge but requires a verbal notification to the town prior to the time of the test.

(4) The prohibition shall not apply to any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the persons and administered under the compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the stormwater drain system.

(b) *Prohibition of illicit connections.*

(1) The construction, use, maintenance, or continued existence of illicit connections to the stormwater drain system is prohibited.

(2) This prohibition expressly includes, without limitation, connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(3) A person is considered to be in violation of this article if the person conveys non-stormwater to the stormwater drain system, or allows such a connection to continue.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-97. Monitoring of discharge.

(a) This section applies to all properties that have stormwater discharges.

(b) Access to properties.

(1) The town shall be permitted to enter and inspect property subject to regulation under this article as often as may be necessary to determine compliance with this article. If a discharger has security measures in force, which require proper identification and clearance before entry onto property, the discharger shall make the necessary arrangements to allow access to representatives of the town.

(2) Existing NPDES permit operators shall allow the town ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge stormwater, and the performance of any additional duties as defined by state and federal law.

(3) The town has the right to establish on any permitted property such devices as are necessary in the opinion of the town to conduct monitoring and/or sampling of the stormwater discharge from the property. Sampling may include turbidity, coliform, nutrients, suspended solids. Other testing devices of existing systems may include video recording, dye testing, etc.

(4) The town has the right to require NPDES permittees discharging stormwater to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at their expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.

(5) Any temporary or permanent obstruction to safe and easy access to the property to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the town and shall not be replaced. The cost of clearing such access shall be born by the person.

(6) Unreasonable delays in allowing the town access to a permitted property is a violation of a stormwater discharge permit and of this article. A person who is the operator of a property with an NPDES permit to discharge stormwater associated with industrial activity commits an offense if the person denies the town reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this article.

(7) If the town has been refused access to any part of the premises from which stormwater is discharged, and is able to demonstrate probable cause to believe that there may be a violation of this article, or that there is a need to inspect and/or sample as part of a routine inspecting and sampling program designed to verify compliance with this article or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the town may seek issuance of a search warrant from any court of competent jurisdiction.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-98. Suspension of stormwater drain access.

(a) *Suspension due to illicit discharge in emergency situations.* The town may, without prior notice, suspend stormwater drain discharge access to a person or business when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the stormwater drain system or waters of the United States. If the violator fails to comply with a suspension order issued in an emergency, the town may take such steps as deemed necessary to prevent or minimize damage to the stormwater drain system or waters of the United States, or to minimize danger to persons.

(b) *Suspension due to the detection of illicit discharge.*

(1) Any person discharging to the stormwater drain system in violation of the article may have their stormwater drain access terminated if such termination would abate or reduce an illicit discharge. The town will notify a violator of the proposed termination of its stormwater drain access. The violator may petition the town for a reconsideration and hearing.

(2) A person commits an offense if the person reinstates stormwater drain access to premises terminated pursuant to this section, without the prior approval of the town.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-99. Notification of spills.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation, has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into stormwater, the stormwater drain system, or waters of the United States said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies, town police, fire rescue, and town offices, of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the town in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the town within three business days of the phone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-100. Enforcement.

(a) *Nuisance.* Any activity that is commenced without acceptance of the Illicit Stormwater Discharge Ordinance or is conducted contrary to an approved plan as required by this article, shall be deemed a public nuisance and may be restrained by injunction or otherwise abated in a manner provided by law.

(b) *Violation notification.* When the town determines that an activity is not being carried out in accordance with the requirements of this article, the town will issue a written notice of violation, to the owner of the property. The notice of violation shall contain:

(1) The name and address of the owner or applicant.

(2) The street address when available or a description of the building structure, or land upon which the violation is occurring.

(3) A statement specifying the nature of the violation.

(4) A description of the remedial actions necessary to bring the development activity into compliance with this article and a time schedule for completion of such remedial action.

(5) A statement of the penalty or penalties that shall or may be assessed against the person to whom the notice of violation is directed.

(6) The notice of violation shall be served up on the person(s) to whom it is directed either personally, in the manner provided for personal service of notices by the court of local jurisdiction or by mailing a copy of the notice of violation by certified mail, postage prepaid, return receipt requested to such person at person's last known address.

(c) *Civil and criminal penalties.* In addition to or as an alternative to any penalty provided herein or by law, any person who violates the provision of this article shall be punished by a fine of not less than $100.00 nor more than $1,000.00 or by imprisonment in the county jail for a period not to exceed 60 days, or by both such fine and imprisonment. Such person shall be guilty of a separate offense for each day during which the violation occurs or continues.

(d) *Costs for restoration, corrective action, abatement, and monitoring.* Any violator may be required to restore land to its undisturbed condition. Notice shall set forth a deadline within which such remediation or restoration must be completed. In the event that restoration is not undertaken within a reasonable time after notice, the town may take necessary corrective action, the cost of which shall become a lien upon the property until paid. Costs to the property owner may include:

(1) The performance of monitoring, analysis, and reporting.

(2) The elimination of illicit connections or discharges.

(3) That violating discharges, practices, or operations shall cease and desist.

(4) The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property.

(5) Payment of costs for town administrative and remediation costs.

(6) Town's cost if they implement source control or treatment BMPs.

If abatement of a violation and/or restoration of effected property is required, the said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the town or a contractor will do the work and the expense thereof shall be charged to the violator.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-101. Appeal of notice of violation.

A notice of violation issued pursuant to this section constitutes a determination from which administrative appeal may be taken to the town council. A statement will be issued that the town's determination of violation may be appealed to the town council by filing a written notice of appeal within 15 days of service of notice of violation. The decision of the town or designee shall be final.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-102. Enforcement measures after appeal.

If the violation has not been corrected pursuant to the requirements set forth in the notice of violation, or, in the event of an appeal within 15 days of the decision of the town upholding the violation, representatives of the town may enter upon the subject property to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, or agent in possession of any premises to refuse to allow the town or their designated contractor to enter upon the premises for the purposes set forth above.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-103. Injunctive relief.

It shall be unlawful for any person to violate any provisions or fail to comply with any of the requirements of this article. If a person has violated or continues to violate the provisions of this article, the town may petition for a preliminary or permanent injunction restraining the person from activities which would create further violation or compelling the person to perform abatement or remediation of the violation.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-104. Alternative compensatory action.

In lieu of enforcement proceedings, penalties, and remedies authorized by this article, the town may impose alternative compensatory action upon a violator. Alternative compensatory action will be established in equitable measures and may include items such as:

(1) Community service.

(2) Attendance at compliance workshops.

(3) Public education efforts.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-105. Violations deemed a public nuisance.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this article is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-106. Criminal prosecution.

(a) Any person that has violated or continues to violate this article shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty cost, per each day of violation, and/or imprisonment for a period of time not to exceed statutory limits.

(b) The town may recover all attorney's fees, court costs, and other expenses associated with enforcement of this article, including sampling and monitoring expenses.

(Ord. No. 2003-45, 11-18-03)

Sec. 14-107. Remedies not exclusive.

The remedies listed in this article are not exclusive of any other remedies available under any applicable federal, state, or local law and it is within the discretion of the town to seek cumulative remedies.

(Ord. No. 2003-45, 11-18-03)

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-345-
Submitted by: Candace Davis
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Consideration of a Resolution to approve the Transportation Impact Fee Study scope of work and fee and allow the Town Manager to enter into a contract with Benesch.

Recommendation:

Item Summary:

ATTACHMENTS

- Agenda Item Summary_Transporation Impact Fee Update_ContractApproval.docx
- Benesch - Submittal for Town of Wake Forest Transportation Impact Fee Study_revisedschedule.pdf
- 2023-xxx_Resolution.docx

Agenda Item: Considera?on of a Resolu?on to approve the Transporta?on Impact Fee Study scope of work and fee and allow the Town Manager to enter into a contract with Benesch.

Summary:

Approval for the Town Manager to enter into a contract with Benesch for the Transporta?on Impact Fee Study. A Request for Proposals, RFP# 2023-0006, was issued on November 3, 2023 and responses were due by 2 p.m. on December 4, 2023. Based on the review of their RFP response, staff engaged with Benesch and requested a scope of work to review. Staff has reviewed the scope of work and is recommending that the Town contract with Benesch for the Transporta?on Impact Study. The proposed fee for the Transporta?on Impact Fee Study is a lump sum fee of $87,000.

A? achments:

Resolu?on
Contract Scope & Fee
Request for Proposals #2023-0006



benesch

Town of Wake Forest

TRANSPORTATION IMPACT FEE STUDY

December 4, 2022





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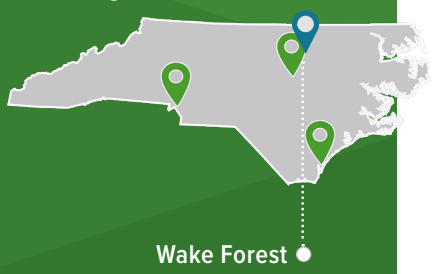
PROJECT NAME
RFP #2023-0006
Transportation Impact Fee Study

PRIME CONSULTANT
Benesch
8000 Regency Pkwy Ste 175, Cary, NC 27518

State Incorporated: IL
Years in Business: 77
Number of Employees: 1000

DESIGNATED CONTACT
Nilgün Kamp, AICP
Director of Public Finance
E nkamp@benesch.com
P 813-825-1225

LOCAL OFFICES
Cary | Charlotte | Wilmington



SUBCONSULTANT
White & Smith, Inc.
Tyson Smith, Esq., AICP
tsmith@planningandlaw.com
Partner, Planner & Attorney
255 King St
Charleston, SC 29401

State Incorporated: SC
Years in Business: 17

December 4, 2023

RE: **RFP #2023-0006: Transportation Impact Fee Study**

To Whom it May Concern:

Benesch is pleased to submit this proposal for the Wake Forest Transportation Impact Fee Study. Included in our Team, White & Smith is based in South Carolina and will provide legal support. With a wealth of experience in impact fees across the Southeast, including Wake Forest, NC, our team brings valuable benefits to the Town of Wake Forest, including the following:

✓ ***We Know Wake Forest:*** Benesch prepared the Town's last impact fee for parks and recreation and is currently updating that study again. Through this experience, we are familiar with local conditions, which will bring efficiencies to the transportation impact fee study. We offer the same team of friendly faces for this update study, which means we will require no learning curve. ***Nilgün Kamp, AICP will oversee this study and her team will deliver a thorough Transportation Impact Fee Study.***

✓ ***Extensive Transportation Impact Fee Experience:*** Benesch's Public Finance Practice has been specializing on impact fee studies, including transportation, over the past 35 years. Our Team was involved in all aspects of impact fees and has been highly active in high growth states such as Florida. We conducted studies through multiple economic cycles for communities with a wide range of demographic characteristics. Through our past and on-going studies, we know how different issues are addressed by different jurisdictions. All of this information will be available to the Town.

✓ ***Comprehensive Transportation Knowledge from a Full-Service Team:*** In addition to impact fees, Benesch specializes in growth management issues, land development regulations, transportation concurrency/development review and other planning issues, which provides us with a better understanding of the interaction between impact fee programs, development review, growth management and economic development goals. Some of our capabilities include developing unique development review processes and impact fee programs that align with local governments' land use and multi-modal policies.

✓ ***Local Presence:*** Benesch's North Carolina offices are located across the state in Cary, Charlotte and Wilmington. Through our transportation planning and design services for NCDOT and jurisdictions in North Carolina, we understand planning and costing of multi-modal transportation facilities. This understanding and information will be integrated into the impact fee study for Wake Forest. Our local presence gives us insight into looking at this transportation impact fee study through a uniquely qualified lens.

We appreciate the opportunity to submit our proposal. Our brief litigation history unrelated to the public finance division is provided on the following page. We look forward to potentially providing our services to Wake Forest once again.

Sincerely,

Nilgün Kamp, AICP
Project Manager | Firm Contact
P: 813-825-1225
E: nkamp@benesch.com

William L. Ball, AICP
Senior Vice President | Florida Division Manager
P: 813-825-1105

Litigation History

CLAIMS & LITIGATION WITHIN THE LAST FIVE YEARS

A detailed litigation history can be provided upon request. In summary, Benesch currently has five open lawsuits. None of the suits listed below are related to our Public Finance division:

- Three suits stem from construction-related personal injuries alleged to have been caused by errors or omissions; one of these suits involves a limousine accident that occurred in a construction zone; one suit involves an injury sustained by a pedestrian in the construction zone of a project designed by Benesch; and the third suit involves a pedestrian fatality that occurred when a drunk driver drove onto the pedestrian path of a bridge designed by Benesch.
- One suit was filed after a combination of heavy rainfall (5.8”) and the Contractor failing to properly maintain the construction site in accordance with the construction documents led to a flooding of 10 adjacent homes.
- Benesch was added as a third-party defendant in a suit on September 25, 2022, which stems from a residential development for which an acquired company, Site Solutions, provided services. The summons received did not include information sufficient to determine the allegations specific to services provided by Site Solutions prior its acquisition by Benesch in November 2014.

During the last five years Benesch has been involved in an additional 12 lawsuits firm wide, which break down as follows:

- Five stemmed from construction-related personal injuries. One of these suits was resolved through direct negotiations and four were resolved during mediation or pre-trial settlement conferences.
- Four stemmed from construction-related property damage. Two of these suits were resolved through direct negotiations and two were resolved during pre-trial settlement conferences.
- One suit was filed by a contractor alleging errors and omissions and was settled through direct negotiations.
- One suit was a nuisance suit filed and subsequently abandoned by the resident of a client for whom Benesch prepared a structural evaluation report that resulted in condemnation of the resident’s property. Benesch and two of its employees were all dismissed from this case.
- One suit was filed by a client for indemnification related to an injury sustained by a user of a facility and was settled during mediation.

TYPE OF FIRM
HISTORY | OWNERSHIP
ORGANIZATION | BACKGROUND

Since 1946, Benesch has successfully completed thousands of projects. The future looks even brighter as multi-disciplined firm continues to enhance infrastructure and communities nationwide – creating spaces and providing connections in ways that make a difference. In December of 2021, Tindale Oliver merged with Benesch, bringing additional infrastructure systems planning capability to our Public Finance team.

Benesch provides industry-leading public finance, mobility planning, multimodal transportation and transit solutions by combining creativity and insight with technical expertise. We deliver quality, innovative finance and infrastructure planning and engineering services that have led to a national reputation for exceptional client service and thoughtful, actionable solutions to issues that government officials face in planning, funding, designing, and implementing projects and policies.

Developing and improving communities through technical studies is a specialty of ours—and helping clients develop a common vision and organizational framework is a large part of what we do. Our talented staff is ready to help you balance your goals and planning needs within the limits of your schedule and budget.

ENR #101 TOP 500 DESIGN FIRMS 2023



WHAT WE DO

Transportation
Roads | Transit | Aviation | Bridges | Railroads

Community Development
Public Finance | Civil/Site | Parks & Recreation

Environmental & Water
NEPA | Potable Water | Stormwater | Wastewater

WHO WE SERVE

Cities & Counties | Federal, State & Local Agencies
Railroads | Transit Authorities | Airports

We routinely tap into our firm's multidisciplinary expertise to support clients across the country. We turn our nationwide capacity and expertise into high-value solutions for local infrastructure challenges.

1946 Incorporated

77 Years in Business

1000 Number of Employees



Benesch is privately held by employees, with a distributed ownership where no one person owns more than 4%.

www.benesch.com

BENESCH DIFFERENTIATORS: *WHY WE'RE A GREAT FIT FOR WAKE FOREST*



Impact Fee Methodology

Benesch principals have published articles on technical approach to developing impact fee programs. These articles discussed and compared various methodologies available, such as consumption based and improvements-based methodologies, set the standard for impact fee studies and have been used by many agencies across the US to develop impact fee programs, including work by other consultants.

Benesch's Economic Growth Impact Fee Methodology

Benesch presented a paper entitled "Smart Growth and Impact Fees" at the Reconciling Impact Fees Symposium in Atlanta. In that paper, Benesch developed a methodology that creates a bridge between consumption-based and needs-based methodologies. In addition, this methodology allows impact fees to be sensitive to the growth rate of various areas within a jurisdiction. Benesch has directly tied the rate of growth in the impact/mobility fee equation and is now using this concept in current ongoing Florida impact/mobility fee studies. Some of the findings of the paper were applied in impact fee studies adopted by the City of Albuquerque (NM), City of Orlando (FL), Marion County (FL), Pasco County (FL) and Indian River County (FL).

Development Review and Growth Management Experience

Benesch's Transportation Planning Services Group specializes on growth management issues, land development regulations, multi-modal transportation concurrency, and other planning issues. This experience will be important in coordinating developer contributions received for transportation capacity by the Town of Wake Forest with the proposed transportation impact fee program.

Trip Characteristics Studies for Impact Fees

Benesch has extensive experience in conducting trip characteristics studies for impact fees. Our trip characteristics database includes 345 studies on 40 different land uses. Data from these studies include trip generation, trip length, and percent new trips for each land use. This information has been used in the development or update of impact fees and the creation of land use plan category trip characteristics for many communities.

ITE Trip Generation Trip Length Subcommittee

Founders of Benesch's Public Finance Practice led the ITE Trip Length Subcommittee, which developed trip length data for more than 30 land uses. We participated on the panel that introduced this information at the 67th Annual Meeting of the ITE.

ITE Trip Generation Multi-Use Development Subcommittee

Benesch participated on the ITE Trip Generation Multi-Use Development Subcommittee. Having completed several multi-use development studies in Florida, they provided valuable input in the data collection and analysis of multi-use developments, as well as in the development of standardized forms to measure the trip generating characteristics of multi-use developments. The result of this

work effort is Chapter 7, "Multi-Use Development," in the 2004 ITE Trip Generation Handbook.

Comparative Databases

Benesch has compiled a cost database that includes unit costs for several infrastructure program areas, including transportation. This database supplements local information, which tends to have a small sample size, and serves as a quality-control mechanism to determine whether the local costs are out of the range of what other jurisdictions experience. Similarly, our revenue credit database compares non-impact fee funding levels between jurisdictions and serves as a quality-control tool to ensure that the data used for impact fee calculations are accurate.

Public Involvement/Presentations

Principals of Benesch have prepared and made more than 700 presentations on fees during the last 35 years. Our staff are qualified to prepare materials for impact fee adoption hearings, respond to questions from citizens and technical committees, and develop strategies that result in the successful implementation of new and updated ordinances. We also have worked very closely with fee evaluation and review committees and have been successful in building consensus among people with different opinions on a variety of fee-related topics.

Infrastructure Planning/Master Plans

Benesch has prepared Long Range Transportation Plans, Transit Development Plans, traffic impact analyses, and other planning documents for local governments. We understand the relationship between fees, master plans, and economic development and growth management goals. With this experience, we address differential needs and funding on a citywide versus subarea basis, and this combination of providing infrastructure planning and funding services is one of the unique capabilities Benesch offers.

Nationally Recognized

Nilgün Kamp is a member of the Growth and Infrastructure Consortium (GIC) (formerly National Impact Fee Roundtable), serving on the Board of Directors. She and team member, Tyson Smith, share their expertise by presenting and moderating at annual GIC meetings.

Institutional Knowledge, Insight & Outcomes

Our knowledge and insight, as described in this section, provide our clients with informative outcomes relevant to their specific needs.

ADDED VALUE

Traffic Engineering and Roadway Design Services

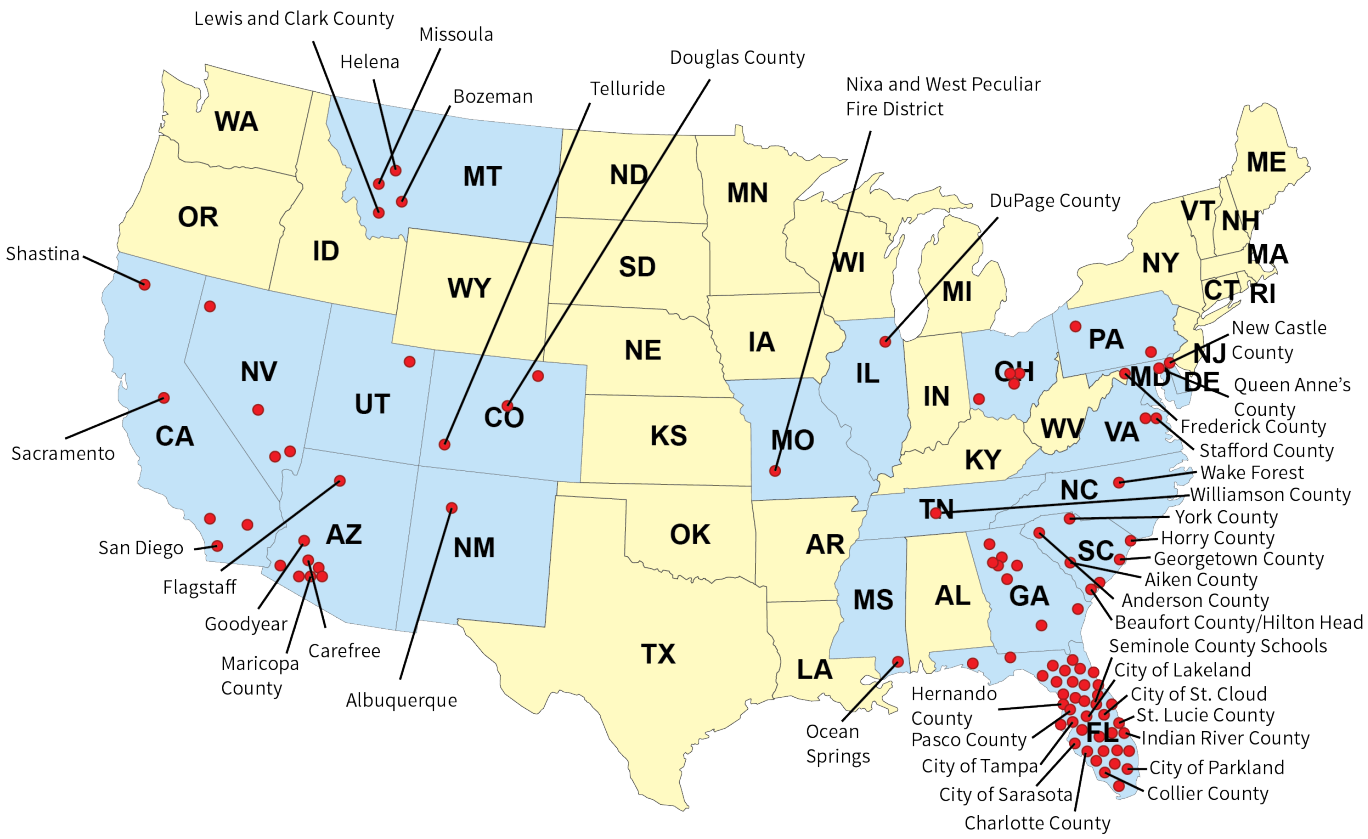
Benesch offers a full range of traffic engineering and roadway design services. We also provide traffic design services for city, county, and state agencies, focusing on applying our traffic engineering expertise to all of our designs in the development of solutions that consider safety, operations, constructibility and cost-effectiveness.





National Impact Fee Experience

The Benesch team has extensive experience with impact fee studies across the nation, specializing in the Southeast. Our extensive national impact fee experience is illustrated in the map below:



Quality Management

Delivering quality studies based on sound technical analyses is the primary objective of our quality assurance/quality control (QA/QC) process. The Benesch QA/QC Program is a company-wide system that provides online planning and tracking to ensure consistency and compliance. Our Quality Management System (QMS) consists of the following:

Project Specific Quality Management Plan (PQMP): Each project at Benesch, regardless of size, begins with creating a customized Project Quality Management Plan, or PQMP. We use an online tool to assist with a series of templates that serve as the basis for each PQMP. Each PQMP identifies which project deliverables will be checked, when they will be checked and how.

Checking in – Who, What, When and How (3WH): The PQMP creator automatically creates a tracking database called the 3WH Tracker (who-what-when-how). The 3WH checker includes QC tasks that are completed before a deliverable is sent to the client. The QC checker e-signs tasks and the QA reviewer is required to sign that the work has been completed and documented. Our Corporate Director of Quality Management monitors this database to ensure that all projects comply with this policy.

Team Communication

The Benesch Team has a reputation for completing projects on time while meeting or exceeding our clients' expectations of quality. This is accomplished through detailed tasks, time management practices, project staff meetings and regular communication. We conduct weekly internal project meetings to discuss the progress of a project and identify potential issues/delays in a timely manner to address them.

Ability to Work Effectively with Town Staff: In addition to internal communication, Benesch will be in close contact with the Town's Project Manager to ensure that the Town is aware of the study progress and any issues related to data collection, schedule, etc. We demonstrated our ability to work with the Town staff during the previous and on-going parks impact fee studies and the same diligence will continue during the transportation impact fee study, if selected.

In this section, we have listed three reference projects with project descriptions, client references and two work samples with links as prompted.

IMPACT FEE STUDIES

City of Hollywood, FL



Background: The City of Hollywood retained Benesch (formerly Tindale Oliver) in 2013 and 2015 to update the City's fire user fees and in 2020 to update its parks impact fee and develop additional impact fees, including a transportation impact fee study.

Knowledge

- The City's growth is primarily through redevelopment projects.
- Need to update the parks impact fee and develop impact fees for multimodal transportation, general government buildings, law enforcement and fire rescue services.

Insights

- Lack of vacant land resulting in high land values.
- Variation in needs by program area and need to demonstrate future revenues in relation to the capital needs.
- Determination of appropriate LOS to use for impact fee calculations.
- Impact of HB 337 on the adoption process.

Outcomes

- Developed impact fee schedules for each service area.
- Calculated phased fee levels in relation to HB 337 requirements.
- Presented study results and responded to questions.
- All fees were successfully adopted.

Key Issues

- City fire user fees
- Multiple impact fees
- Technical studies
- Impact of HB 337

Dates of Service

1/2020 - On-going (est. impact fee study 12/2022)

Client Reference

Mark Johnson
Project Manager
City of Hollywood
2600 Hollywood Boulevard,
Room 422
Hollywood, FL 33021
P: 954-921-3991
E: mljohnson@hollywoodfl.org

CLICK TO VIEW SAMPLE REPORT

IMPACT FEE AND IN-LIEU FEE STUDY

City of Hallandale Beach, FL



Background: Benesch (formerly Tindale Oliver) was retained by the City of Hallandale Beach to prepare an impact fee for four service areas and in-lieu fees for affordable housing and parking. This study developed all impact fee variables and reviewed Broward County's regulatory land use requirements for affordable housing and the City's parking requirements and inventory in developing the in-lieu fees.

Knowledge:

- Changing demographics with increase in younger population and significant seasonal population.
- County requirement to provide affordable housing for certain significant land use/ zoning changes.
- Need to develop funding for necessary infrastructure.

Insights:

- Limited vacant property, suggesting need for high level of redevelopment in future.
- Significance of City's CRA and Activity Centers in the Land Use Plan.
- Fluctuations in cost of providing housing along waterfront vs. rest of city.
- High level of construction activity in southeast Florida, resulting in high construction costs.

Outcomes:

- Developed impact fees for multimodal transportation, parks and recreation, fire rescue and law enforcement service areas. All fees were successfully adopted.
- For multimodal transportation impact fee, developed alternative scenarios measuring all travel vs. travel on city roads.
- Provided parameters needed to establish parking in-lieu fee.
- Conducted research on practices used by other jurisdictions in Broward County and Florida on parking and affordable housing in-lieu fees.
- Provided options in adopting in-lieu fees for affordable housing mitigation to respond to County regulations and assist in increasing future affordable housing units.

Key Issues

- Changing demographics
- Affordable housing requirements
- The need for infrastructure funding
- Changes in impact fee legislation

Dates of Service

8/2017 - 2/2022

Client Reference

Vanessa J. Leroy, Director
Community Enhancement & Sustainable Development Department
City of Hallandale Beach
400 South Federal Highway
Hallandale Beach, FL 33009
P: 954-457-1376
E: vleroy@hallandalebeachfl.gov

IMPACT FEE STUDIES
Orange County, FL





Background: Orange County has historically implemented impact fees to address the infrastructure costs associated with new growth. In 2005, to address cost and land value increases, the County retained Benesch to update several fee areas, including fire rescue and schools and develop a new parks and recreation facilities impact fee program. In 2011, the County retained Benesch to update its transportation and parks impact fees. In 2016, Benesch was retained again to update the parks, fire rescue and law enforcement impact fees; in 2017, to update the transportation impact fee, and in 2018, the school impact fee once again. Finally, in 2022 Benesch completed the update of the County's fire rescue, law enforcement and parks impact fees. In addition, Benesch provided services related to review of alternative impact fee studies.

Knowledge
- High growth county, ranking 2nd out of 67 Florida counties in terms of absolute growth that will be added by 2045, and 7th in terms annual population growth rate.
- 2nd highest in terms of sales tax per capita due to high level of tourism activity.
- High level of seasonal residents/visitors impacting service levels.

Insights
- Develop demand component based on fire alarms/emergency calls received as well as functional population as potential options to the County.
- Recommendations on how to treat the County's large inventory of undeveloped habitat land in the parks and recreation impact fee analysis.
- Develop a multimodal transportation impact fee for the County's Alternative Mobility Area (AMA) and a roadway-based fee for the rest of the unincorporated county.
- Developed transportation impact fees using three different methodologies: consumption-based, improvements-based, and asset value based.
- Introduced fee variations among rural, suburban, and urban areas for the transportation impact fee.

Outcomes
- Developed impact/multimodal fee structures that supported the County's growth management and infrastructure funding goals.
- Successfully completed multiple meetings with stakeholders, elected officials, and the public.
- All studies were successfully adopted.

Key Issues
- High growth county
- Increasing cost levels
- Continuous need to add infrastructure

Dates of Service
07/2004 - 1/2022 (multiple studies)

Client Reference
Alan Marshall
Orange County
400 E South Street
Orlando, FL 32801
P: 321-370-9852
E: alan.marshall@ocfl.net

CLICK TO VIEW SAMPLE REPORT

Legend

- Public Finance Team
- Transportation Planning Team
- Subconsultant

TOWN OF WAKE FOREST

Project Director
- Nilgün Kamp, AICP

Impact Fee Technical Study
Task Leader
- Nilgün Kamp, AICP
- Robert Layton
- Steve Infanti, AICP

GIS
- Michelle Lopez, AICP, GISP, ENV

Cost Estimator
- Raymond Hayes, PE

Legal Support
- Tyson Smith, AICP

Meetings & Presentations
Task Leader
- Nilgün Kamp, AICP

Senior Advisor
- Elise Bielen, AICP

Nilgün Kamp, AICP

*Project Director - **Tampa Office***



WHAT NILGÜN BRINGS TO THIS PROJECT:

Ms. Kamp has served as the project manager for impact fees, assessment, and user fee development and implementation studies for transportation, fire, EMS, schools, law enforcement, correctional facilities, government buildings, solid waste, libraries, and parks and recreational facilities. Her experience also includes demographic and travel behavior analysis, demographic and population projections for funding studies, travel behavior analysis, economic and fiscal impact studies, demand analysis, and other related mobility fee and impact fee support activities.

Education

MA, Economics, University of South Florida

MA, International Relations & Pacific Studies, University of California San Diego

BA, Economics, University of California San Diego

Years of Experience: 31

Project Experience

Transportation/Mobility

- Collier County (2005, 2008, 2010, 2013, 2018, 2023)
- Hendry County (2023)
- St. Johns County (2023)
- City of Plant City (2023)
- Lake County (2007, 2022)
- Volusia County (2021)
- City of Newberry (2021)
- Palm Beach County (2014, 2021)
- St. Lucie County (2016, 2021)
- City of Orlando (2012, 2021)
- City of Brooksville (2021)
- City of Hollywood (2020)
- Flagler County (2020)
- Manatee County (2020)
- Martin County (2020)
- City of Lakeland (2008, 2014, 2019)
- Hernando County (2013, 2019)
- Indian River County (2004, 2013, 2019)
- Hillsborough County (2016, 2019)
- City of Apopka (2019)
- Sumter County (2008, 2014, 2018)
- Collier County (2005, 2008, 2010, 2013, 2018)
- City of Mount Dora (2018)
- City of Tamarac (2018)
- City of Oviedo (2005, 2013, 2018)
- City of Hallandale Beach (2018)
- Orange County (2013, 2017)
- City of Bozeman, MT (2007, 2017)
- City of Sarasota (2016)
- City of St. Cloud (2003, 2006, 2016)
- City of Palm Beach Gardens (2016)
- Village of Royal Palm Beach (2016)
- City of Tampa (2007, 2014)
- Marion County (2014)
- Brevard County (2014)
- Charlotte County (2013)
- Osceola County (2011)
- City of North Port (2011)
- City of Haines City (2009)
- Leon County (2008)
- Panama City (2008)
- City of Helena, MT (2007, 2009)
- Lewis & Clark County, MT (2007, 2009)
- Highlands County (2006)
- City of Deltona (2006)
- City of Ft. Pierce (2006)
- Polk County (2005, 2009)
- City of Palm Coast (2004)

Steve Infanti, AICP

*Senior Planner - **Tampa Office***



WHAT STEVE BRINGS TO THIS PROJECT:

Mr. Infanti is a certified planning professional with experience in transportation planning and GIS applications, including travel demand modeling using Cube Voyager models and mapping, geodatabase design and geospatial analysis using ESRI ArcGIS. He has prepared travel demand analysis for multiple transportation impact fee studies and conducted numerous traffic impact studies, general traffic analysis, freight corridor screenings, crash data analysis and other similar projects.

Education
Graduate Certificate, GIS Applications Specialist, Sault College, ON

BA, Geography, Laurentian University

Years of Experience: 20

City of Lakeland - Impact Fee Updates - Lakeland, FL

Travel Demand Modeler: Benesch was retained to update the City of Lakeland transportation impact fee; multi-year contract to update several impact fee programs, including parks and recreation, fire protection, and law enforcement, indexing studies. In 2015, to update and convert the City's Roadway Transportation Fee to a Multimodal Transportation Fee, provide City with more flexibility in its program expenditures. In 2019, preparation of technical study to document current cost, credit, and demand components associated with providing capital facilities and resulting fee schedules. Benesch, formerly Tindale Oliver, has been retained since 1991 to update the City of Lakeland impact fees.

Pasco County - Mobility Fee Update Study - Pasco County, FL

Planner: This project involved the following: conducted activities to encourage higher-density urban and transit-oriented development and incentivize job-creating land uses. Fee assessment for capital cost of roads, transit, and bicycle/pedestrian facilities needed to support new growth and incorporates into fee structure slower growth rates, different mobility and quality of service goals in different areas of the county, and modified transportation revenue sources to create an innovative tiered rate structure.

Robert Layton

*Senior Planner - **Tampa Office***



WHAT ROBERT BRINGS TO THIS PROJECT:

Mr. Layton's expertise is in public finance studies, including impact fee studies for transportation, fire, EMS, schools, law enforcement, correctional facilities, government buildings, solid waste, libraries and parks and recreational facilities. He has experience in the development of cost, credit and demand components for transportation impact fees. He maintains Benesch's cost and credit databases that include data from multiple jurisdictions and are used for quality control measures.

Education
BA, Economics/Business Administration, University of Florida

Years of Experience: 15

***Project Experience* Transportation/ Mobility**

- Collier County (2005, 2008, 2010, 2013, 2018, 2023)
- Hendry County (2023)
- St. Johns County (2023)
- City of Plant City (2023)
- City of Sarasota (2016, 2023)
- Marion County (2014, 2023)
- Lake County (2007,2022)
- Volusia County (2022)
- City of Groveland (2022)
- Collier County (2013,2022)
- City of Orlando (2012, 2021)
- Flagler County (2020)
- Manatee County (2020)
- Martin County (2020)
- Hernando County (2013, 2019)
- Indian River County (2004, 2013, 2019)
- Sumter County (2008, 2014, 2018)
- Orange County (2013, 2017)
- Hernando County (2013, 2015)
- City of Lakeland (2013, 2015)
- Marion County (2014)
- Osceola County (2011, 2014)
- Sumter County (2008, 2014)
- City of Lakeland (2013, 2015)
- City of Tampa (2009, 2014, 2017)
- Osceola County (2011, 2014)
- Charlotte County (2013)
- Indian River County (2013)
- City of North Port (2011)
- City of Haines City (2009)
- City of Helena (MT) (2007, 2009)
- Polk County (2009)

Raymond Hayes, PE

*Cost Estimator - **Cary Office***



WHAT RAYMOND BRINGS TO THIS PROJECT:

Mr. Hayes has over 25 years of experience as a Construction Project Manager working for a large contractor, NCDOT and local municipalities. His work experience covers all aspects of roadway projects from constructability review and project estimating/ bidding to bid review, construction project management and contract administration. Mr. Raymond will serve as the Cost Estimator for this study.

Education
BS, Civil Engineering, North Carolina State University

Years of Experience: 25

Registrations
Professional Engineer: NC: 025932

NCDOT Division 5 - On-Call CEI - Locally Administered Projects Construction Oversight - NC

NCDOT, Locally Administered Projects Manager, Division 5: Mr. Hayes serves as the Division 5 Locally Administered Projects Manager. His duties include representing the NCDOT to ensure LAP projects are done in accordance with NCDOT Standards and FHWA procedures from design through construction. He coordinates project work with NCDOT design groups, NCDOT Division 5, NCDOT District Offices and all municipalities within Division 5.

Town of Apex - Intersection Improvements Apex Peakway/NC 55 and Apex Peakway - Olive Chapel Rd. - Apex, NC

Contractor Project Manager: Mr. Hayes served as the Contractor Project Manager for the intersection improvements at the Apex Peakway / NC 55 and Apex Peakway / Olive Chapel Rd. The project consisted of turn lane additions, road widening, pedestrian improvements and signal modifications.

Town of Cary - Walnut St. Bridge and Pedestrian Improvements - Cary, NC

Contractor Project Manager: Mr. Hayes served as the Contractor Project Manager for the widening of the Walnut St. bridge. The project widened the Walnut St bridge over US 1/US 64 and improved pedestrian facilities along Walnut St.

Michelle Lopez, AICP, GISP, ENV SP

*GIS Specialist - **Cary Office***



WHAT MICHELLE BRINGS TO THIS PROJECT:

Ms. Lopez has experience managing, creating, manipulating, analyzing and mapping data in projects for public agencies across North Carolina, South Carolina, Virginia, Michigan and California. She has prepared NEPA/SEPA environmental documentation, including Community Impact Assessments (CIAs), Indirect and Cumulative Effects (ICE) assessments, feasibility studies, Farmland Conversion Impact Ratings, Minimum Criteria Determination Checklists (MCDCs), Categorical Exclusions (CEs) and State Environmental Assessments (SEAs). Ms. Lopez will serve as the GIS specialist for this study.

Education
MS, Geospatial Information Science and Technology, North Carolina State University
BS, Environmental Science, University of North Carolina Wilmington

Years of Experience: 5

Town of Cary - FY22 ADA-Compliant Greenway Crossings - Cary, NC

GIS Specialist: The Town of Cary sought to evaluate 36 greenway trail ramps adjacent to public roads. Benesch performed the evaluation to determine any required upgrades to meet current ADA greenway standards. Ms. Lopez created the plan maps for all the trail ramp locations and pavement marking quantities.

City of Gastonia, NC - FY 23 Resurfacing of Streets

GIS Lead: Benesch, in partnership with WithersRavenel, assisted the City of Gastonia for their 2023 street resurfacing project. The project consists of four tasks: (1) Pavement Repair Survey (PRS), (2) Map Book, Project Quantities and Engineers Estimate, (3) Project Construction and Inspection (CEI), and (4) Contract Administration. Ms. Lopez assisted and managed the field work for task 1 and created a custom mobile GIS Field Maps application used to collect field data for over 40 miles. The data was collected on iPads and paired with an Arrow 100+ GPS/GNSS receiver.

Elise Bilen, AICP

*Senior Advisor - **Cary Office***



WHAT ELISE BRINGS TO THIS PROJECT:

Ms. Bielen joins Benesch with 13 years of experience in project planning. She is a dedicated and experienced Transportation Planning Project Manager with a strong background in analyzing and documenting the impacts of transportation and infrastructure projects on human and natural environments. She has refined expertise in utilizing various data sources, including spatial (GIS) data, demographic (Census) data and online databases, to inform project decision-making. Ms. Bielen will serve as the senior advisor for this study.

Education
BA, Double Major Sociology and Spanish, Wake Forest University

MCRP, City and Regional Planning, University of North Carolina at Chapel Hill

Years of Experience: 13

NCDOT - Town of Waxhaw Paved Trails & Sidewalk Feasibility Study

Lead Planner: This project will help the Town to develop a plan that highlights needed improvements with corresponding investments over the next five years. The study will help establish an east-west spine along Waxhaw's portion of the Twelve Mile Creek system which is designated as the Carolina Thread Trail. The project will include coordination with the project team and stakeholders, corridor study, concept plans and observations along with detailed planning documents that include preliminary environmental considerations and to determine alignments / preferred bridge locations and cost estimates. Ms. Bielen's responsibilities include overseeing the planning efforts associated with this project.

NCDOT - Structure Management Unit Prescreening 5.0 - Statewide, NC

Lead Planner: Benesch is performing an initial screening of bridge replacement projects in Divisions 1 through 14. Efforts include an overarching evaluation of the project to determine anticipated scope, potential impacts due to adjacent site constraints and an expected time to deliver the project. Ms. Bielen's responsibilities include overseeing the planning efforts associated with this project.

Tyson Smith, AICP

*Legal Support - **Charleston, SC***



WHAT TYSON BRINGS TO THIS PROJECT:

Tyson Smith has been working in local government law and landuse planning since 1992, first, and an in-house planner and, since, 2000, as a planning consultant and attorney. He has served over 50 jurisdictions around the country on matters related impact fees and other public facility tools, including concurrency/APF, tax increment financing, development agreements and exactions. Mr. Smith is the former chairmen of the board for the Growth & Infastructure Consortium.

Education
BA, Economics, UNC

MA, University of Florida
Juris Doctor, University of Florida

Years of Experience: 31

WHITE & SMITH, LLC

RECENT IMPACT FEE CLIENTS

Florida: Apopka, Aventura, Casselberry, Citrus County, Brevard County, Collier County, Coral Springs, Deltona, Escambia County, Flagler County, Ft. Pierce, Hernando County, Hillsborough County, Indian River County, Inverness, Kissimmee, Lakeland, Manatee County, Marion County, Orange County, Orlando, Osceola County, Oviedo, Palm Beach County, Palm Coast, Panama City, Pasco County, Sarasota, Sarasota County, St. Johns County, St. Lucie County, and Tavares.

Nationwide: Washoe County (Reno, NV), Nye County (NV), Missoula (MT), Bozeman (MT), Georgetown County (SC), Aiken County (SC), Anderson County (SC), Cheyenne (WY), Helena (MT), Queen Anne's County (MD), Sunbury (OH), Delaware (OH), Fairfield (OH), Garden City (GA), Cary (NC), Salt River Pima Indian Community, Avondale (AZ), Flagstaff (AZ), Queen Creek (AZ), Maricopa County (AZ), Goodyear (AZ), Yuma (AZ).

TOWN OF WAKE FOREST - TRANSPORTATION IMPACT FEE STUDY *SCOPE OF SERVICES*

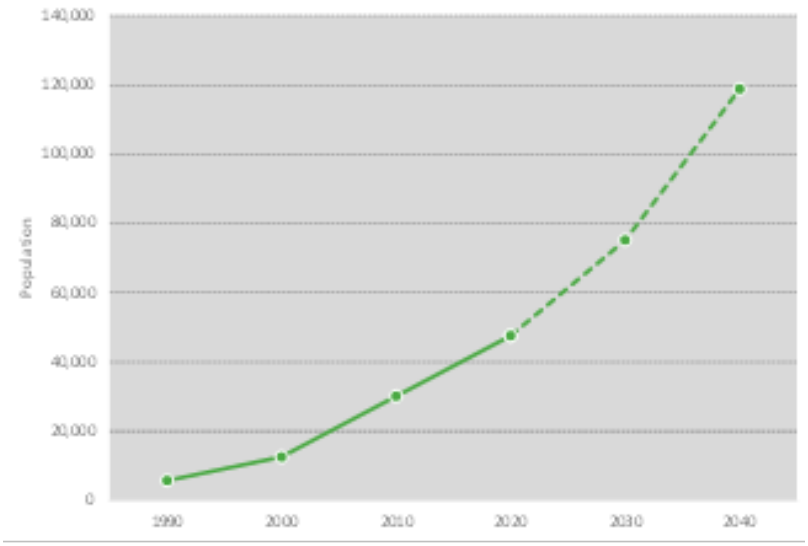
Introduction

Located just north of Raleigh and northeast of North Carolina's Research Triangle Park, the Town of Wake Forest is home to almost 57,000 residents. As shown in Figure 1, the Town has been experiencing significant growth since its incorporation in 1990 primarily due to the activities of the Research Triangle and availability of lower cost housing. Between 1990 and 2023, the Town's population increased by approximately 42,000 residents or 725 percent. The Town's population projections indicate 71,000 additional residents or a population increase of 150 percent by 2040. Residential permitting trends shown in Figure 2 further indicate high growth levels over the past several years.

Given these trends, the Town implemented impact fees for fire and parks, recreation and cultural resource facilities. The Town's ability to charge impact fees is recognized and governed by Senate Bill 576 that was passed in 1989 by the General Assembly of North Carolina. At this time, the Town is interested in exploring the possibility of implementing a transportation impact fee and requested proposals from qualified firms.

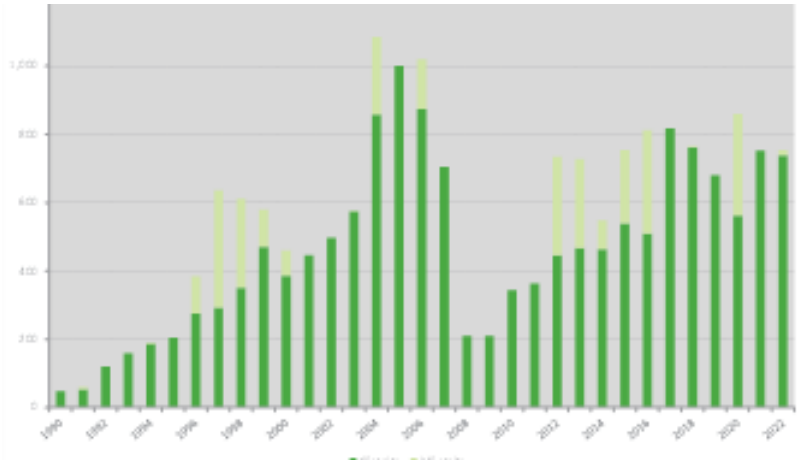
The Benesch Team is best qualified to meet the Team's needs. Our Team of planners, engineers, economists, attorneys, and GIS specialists with in-depth experience in impact fee studies for a wide range of program areas, including transportation. We completed the development and update of over 400 impact fee studies, including many transportation/ multi-modal/mobility fees. We also updated the Town's parks, recreation and cultural resources impact fee in 2018 and are currently working on the update of this study again. This experience provides us with an understanding of local conditions, which will be useful while preparing the transportation impact fee study for the Town of Wake Forest.

Figure 1: Population Growth Trends (1990-2040)



Source: Town of Wake Forest Community Plan

Figure 2: Building Permit Activity



Source: Town of Wake Forest

In addition to impact fee experience, the Benesch Team has prepared Long Range Transportation Plans and assisted local governments with transportation concurrency, alternative transportation impact fee analysis, administrative manuals and other related work, and understands the relationship between impact fees, master plans, and economic development and growth management goals.

This scope of services to prepare the transportation impact fee study is organized into four major tasks that outline the analysis related to initial background review/methodology evaluation, technical analysis to develop the fee, a technical report, and meetings/presentations. The work plan for each of the four major tasks is presented in the remainder of this section.

TASK 1: BACKGROUND REVIEW & KICK-OFF MEETING

Upon receipt of the Notice to Proceed, Benesch will coordinate with the Town for the collection of the specific studies, data, current policies and procedures, related ordinances, and other information necessary to complete the study. Examples of the documents that will be reviewed include:

- Wake Forest Comprehensive Transportation Plan (2021)
- Wake Forest Community Plan (2023)
- Affordable Housing Plan (2022)
- Five-Year Capital Improvements Plan

Benesch will review the background information and facilitate a kick-off meeting with key Town staff to discuss major technical, legal and policy issues; coordinate staff/ Benesch responsibilities; and refine the project schedule as necessary. Some of the topics that will be discussed include:

- Role of transportation impact fees in Wake Forest;
- Roadway-based fees vs. multi-modal fees;
- Impact fee methodologies;
- Cost trends;
- Current funding source for transportation capacity projects;
- Future needs/projects;
- Coordination of transportation impact fees with developer contributions; and
- Any administrative or implementation related issues/ concerns.

TASK 2: TECHNICAL ANALYSIS

This task addresses the development of the transportation impact fee, which will reflect the capital costs of providing transportation infrastructure in Wake Forest. This work effort includes the development of the demand component, a review of the design, construction, right-of-way (ROW) and other related costs, and credits due to other funding allocated to transportation capacity projects. The methodology used in the study will comply with all the legal requirements.

Subtask 2.1 – Existing Facilities, LOS and Population Growth

This task will evaluate the Town's inventory of roadways classified as collectors and above along with adopted level of service (LOS) standards. Population trends and projections will also be reviewed.

Subtask 2.2 – Demand Component

The demand component of the roadway-based transportation impact fee is measured in terms of vehicle miles of travel (VMT), and for multi-modal transportation impact fees, it is measured in terms of persons miles of travel (PMT). Benesch has an extensive database that includes trip characteristics studies for more than 40 land uses, which measure trip generation rate, trip length and capture trips for each land use. We have used this database in previous transportation impact fee studies.

The demand component will be developed based on secondary data sources, such as trip length information from the travel demand model (Triangle Regional Model, TRMG2 v1.3, released August 2023), the latest ITE Trip Generation Handbook (11th Edition), Benesch's trip characteristics database, and any other available data.

Benesch will discuss common land use categories included in impact fee schedules and refine the schedule of land uses based on input from the Town regarding types of developments that are being permitted.

Subtask 2.3 – Cost Component

The cost component for the transportation impact fee will be developed to reflect the current cost of adding capacity in Wake Forest on roads that are classified as collectors and above. Cost elements reviewed will include design and engineering inspection, construction, right-of-way (ROW) and other related costs. We will review recent bids, recently completed local projects (within the past five years), recent ROW purchases or appraisals and other relevant documents to identify service facility improvement costs that may be considered in the calculation of the cost component of the impact fee formula for the Town. This information will be compared to and/or supplemented with Benesch's cost databases that include information from other jurisdictions. This analysis will be documented in the technical report.

Subtask 2.4 –Credit Component

Benesch will review historical and projected transportation capital improvement funding sources and expenditures for land/ROW, construction, design, and engineering inspection in Wake Forest.

Debt service (both existing and anticipated over the period of the adopted Capital Improvements Plan) will be reviewed to determine the amount creditable for capital expansion projects. Based on this information, the credit component of the transportation impact fee equation will be developed.

This review also will include any applicable state and local sources used for transportation capital expansion projects in Wake Forest, such as fuel tax, state funding, etc. as appropriate.

Subtask 2.5 – Fee Schedule and Comparison
Based on the results of Tasks 1 and 2, a fee schedule will be developed. The calculated fees will be compared to those adopted by nearby or similar jurisdictions. The comparison will present adopted fee rates, date of the most recent technical study and adoption percentage, as information is available.

Recommendations for the schedule of future updates will be included in the technical report.

TASK 3: TECHNICAL REPORT & ORDINANCE

Subtask 3.1 – Draft Technical Report
A draft technical report documenting the results of Tasks 1 and 2 will be prepared and submitted for review by the Town staff. The technical report will include all information, estimates, projections and data analysis, as well as any assumptions made and methodologies employed to complete these tasks.

Subtask 3.2 – Final Technical Report
Upon receipt of comments from the Town, Benesch will make the necessary revisions to the draft report and prepare the final report, which will incorporate input from the Town, Board of Commissioners and other community groups and stakeholders as appropriate.

Subtask 3.3 – Ordinance Preparation
White & Smith (WS) will develop an ordinance and related resolutions as necessary that will fulfill all legal requirements. The document will be delivered to the Town Attorney in electronic format for review and edits. Any revisions will be incorporated into the final ordinance document.

The Benesch Team will also assist the Town with updates to the Unified Development Ordinance (UDO) to incorporate impact fee procedures.

TASK 4: MEETINGS AND PRESENTATIONS

As part of this study, the following six meetings and presentations are envisioned to be conducted:

- Kick-off meeting (virtual);
- One interim meeting with the Town staff and administration to review preliminary findings (virtual);
- One meeting with Town staff and administration to review draft report findings and prepare for public meetings (virtual);
- One meeting with the stakeholders, including adjacent municipalities and community partners such as Triangle Community Coalition, Homebuilders Association, Capital Area Metropolitan Planning Organization, and general public to present study results, respond to question and obtain input;
- One meeting with the Planning Board to present study results and obtain input; and
- One meeting with the Board of Commissioners to present study results and obtain input/approval.

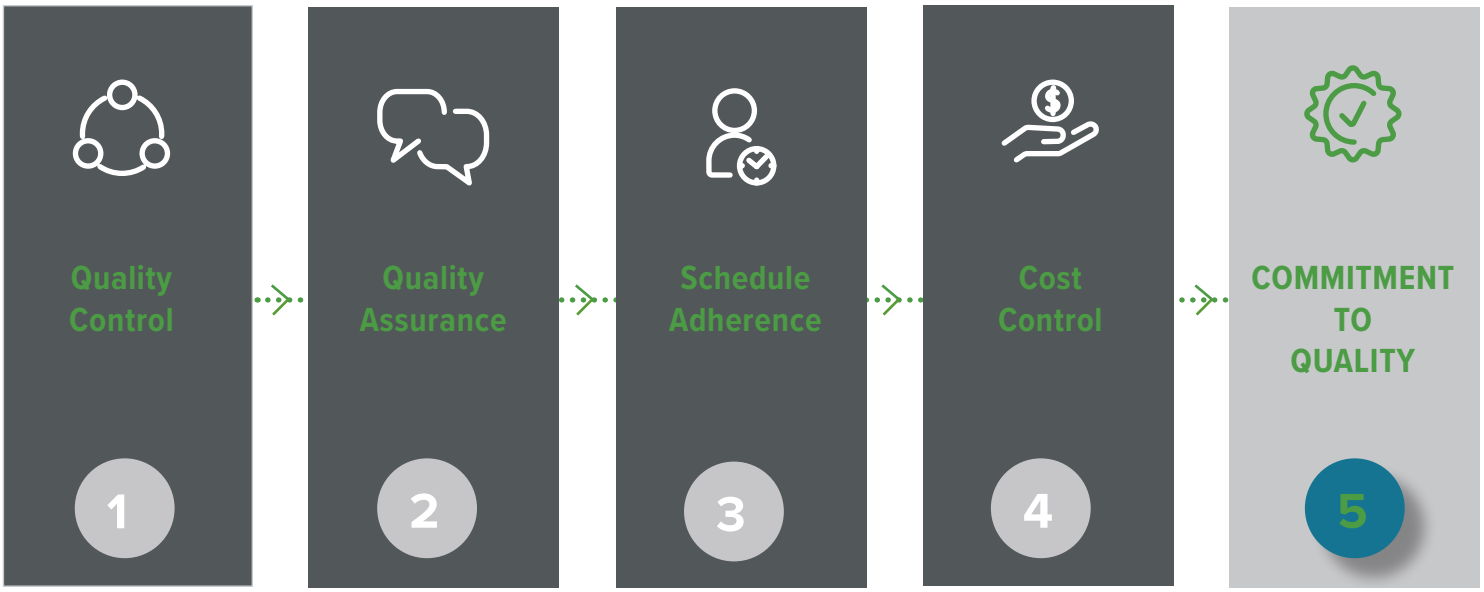


For all presentations, Benesch will prepare user-friendly, easy-to-follow materials in PowerPoint and provide drafts to Town staff for review prior to each meeting/ presentation. In addition to these formal meetings, Benesch will be in close contact with the Town's Project Manager to ensure that the Town is aware of the study's progress. A project schedule is included in Section 5.

TOWN OF WAKE FOREST - TRANSPORTATION IMPACT FEE STUDY *Project Schedule*

A preliminary schedule is provided in the table below. Upon receipt of the contract, this schedule will be reviewed with the Town's Project Manager and, if needed, will be modified to better accommodate the Town's needs. With a dedicated Public Finance Group and other staff experienced in public finance-related analyses, Benesch has the necessary resources to meet most desired time frames and still provide a high-quality product.

Task Description	Tentative Schedule
Receipt of Signed Contract	January 5, 2024
Submittal of Data Needs Memo	January 10, 2024
Kick-off Meeting (Virtual)	Week of January 22, 2024
Receipt of Requested Data	February 29, 2024
Technical Analysis	March - May, 2024
Submittal of Draft Report	May 17, 2024
Draft Report Review Meeting with Town Staff (Virtual)	Week of May 20, 2024
Submittal of Draft Ordinance	June 5, 2024
Stakeholders' Meeting	June-July, 2024
Presentation to the Planning Board	August, 2024
Presentation to the Board of Commission	September, 2024
Submittal of Final Report & Ordinance	Two weeks after receipt of all comments



TOWN OF WAKE FOREST - TRANSPORTATION IMPACT FEE STUDY *Project Budget*

The professional fees to develop the transportation impact fee technical study for the Town of Wake Forest are estimated at $86,855, which includes three virtual and three in-person meetings. This is a lump sum budget, and the Town will be invoiced monthly for the portion of the work completed. Only the meetings that take place will be invoiced.

The table on following page details the professional fees to prepare the transportation impact fee study.

Task #	Task Description	Project Director	Senior Planner	Legal Attorney	Planner/ Engineer	Admin/ Clerical	Total Task Hours	Total Cost Per Task
		$265.00	$175.00	$250.00	$125.00	$75.00		
Task 1	**BACKGROUND REVIEW/ DATA COLLECTION**	9.0	17.0	6.0	14.0	2.0	48.0	$8,760.00
	Send Data Request Memorandum	1.0	2.0			1.0	4.0	$690.00
	Review Background Materials	8.0	15.0	6.0	14.0	1.0	44.0	$8,070.00
Task 2	**TECHNICAL STUDY**	28.0	71.0	12.0	98.0	6.0	215.0	$35,545.00
	Inventory/LOS/Population Projections	3.0	8.0	2.0	12.0	1.0	26.0	$4,270.00
	Demand Component	4.0	9.0	2.0	11.0	1.0	27.0	$4,585.00
	Cost Component	6.0	22.0	2.0	35.0	1.0	66.0	$10,390.00
	Credit Component	5.0	18.0	2.0	22.0	1.0	48.0	$7,800.00
	Impact Fee Schedule and Comparison	8.0	11.0	2.0	18.0	1.0	40.0	$6,870.00
	Schedule for Future Updates	2.0	3.0	2.0		1.0	8.0	$1,630.00
Task 3	**TECHNICAL REPORT & ORDINANCE**	20.0	18.0	54.0	10.0	3.0	105.0	$23,425.00
	Draft Technical Report	8.0	12.0	8.0	4.0	1.0	33.0	$6,795.00
	Final Technical Report	4.0	6.0	4.0	2.0	1.0	17.0	$3,435.00
	Draft & Final Ordinances	8.0		42.0	4.0	1.0	55.0	$13,195.00
Task 4	**MEETINGS & PRESENTATIONS**	55.0	19.0	0.0	8.0	3.0	85.0	$19,125.00
	Kick-off Meeting (Virtual)	3.0	3.0			1.0	7.0	$1,395.00
	Interim Staff Meetings (2, Virtual)	4.0	4.0		2.0	1.0	11.0	$2,085.00
	Presentations (3, In-Person)	48.0	12.0		6.0	1.0	67.0	$15,645.00
Project Total		112.0	125.0	72.0	130.0	14.0	453	**$86,855.00**

Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

► **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See **Specific Instructions** on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

Alfred Benesch & Company

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☑ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ►

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

35 West Wacker Drive, Suite 3300

Requester's name and address (optional)

6 City, state, and ZIP code

Chicago, IL 60601

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN,* later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–		–				

or

Employer identification number

3	6	–	2	4	0	7	3	6	3

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here **Signature of U.S. person** ► Kristin S. Horn **Date** ► 01/02/2023

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9.*

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

RESOLUTION 2023-XX

RESOLUTION AUTHORIZING THE TOWN MANAGER TO EXECUTE, ON BEHALF OF THE TOWN OF WAKE FOREST, THE PROFESSIONAL SERVICES CONTRACT FOR THE TRANSPORTATION IMPACT FEE STUDY

WHEREAS, the Town's high quality of life and economic prosperity has attracted many newcomers to the area, presenting many opportunities and challenges associated with growth; and

WHEREAS, the Town's transportation infrastructure will soon become inadequate to handle the projected growth at existing levels of service. In order to serve the existing and projected population growth, public facilities must be expanded; and

WHEREAS, the Town's existing one and a half cents ($.015) authorized in the FY 2021 budget policy for transportation initiatives is not sufficient; and

WHEREAS, the Town desires to better address the challenge of increased traffic and ensure residents and visitors have a safe, efficient, flexible, innovative, and inclusive multi-modal transportation system by implementing the adopted 2021 Comprehensive Transportation Plan; and

WHEREAS, the Town's ability to charge impact fees is recognized and governed by Senate Bill 576 that was passed in 1989 by the General Assembly of North Carolina.; and

WHEREAS, the Town is interested in exploring the possibility of implementing a transportation impact fee to address the infrastructure costs associated with new growth and requested proposals from qualified firms.; and

WHEREAS, consistent with the Town's purchasing policy, on November 3, 2023, the Town published a Request for Proposals (RFP) inviting interested firms to submit; and

WHEREAS, after review of the proposal submission and impact fee experience, Alfred Benesch & Company (Benesch) was selected as the qualified firm to provide a scope, workplan, and timeline for review; and

BE IT RESOLVED by the governing body of the Town of Wake Forest hereby authorizes the Town Manager to execute a contract with Benesch for the Transportation Impact Fee Study.

Adopted and effective this the _____ day of _____ 2023.

_____

Vivian A. Jones

Mayor

ATTEST:

_____

Theresa Savary

Town Clerk

APPROVED AS TO FORM:

_____

Hassan Kingsberry

Town Attorney

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-329-
Submitted by: Aileen J. Staples
Submitting Department: Finance
Meeting Date: December 19, 2023

SUBJECT
Consideration of purchase of generation systems from Power Secure, Inc.

Recommendation:
Approval as submitted

Item Summary:

ATTACHMENTS

- Generator Purchase _summary.pdf
- Generator Replacement Cost Breakdown.pdf
- Resolution 2023-xx Generator Replacement Purchase.docx
- PRP 2023.12.07 Town of Wake Forest RFP#003-2023 Revised Signed RT.pdf

Consideration of approval of resolution authorizing the purchase of generation systems from Power Secure, Inc.

Summary: Pursuant to NC G.S. 143-129, sealed bids were received on October 10, 2023, for eight (8) generation systems for various locations. One bid was received from Power Secure, Inc. Staff met with representatives from Power Secure, Inc. and recommends the Board approve the purchase of generator replacements for a total of $4,944,914.

Attachments: Resolution; Summary of Pricing and Location; Bid from Power Secure, Inc.

Generator Location		*Price*
Public Works Operation Center	$	403,771
2101 S Main Street - Eatery 1 and 2		734,758
2018 S Main Street - Pat Murnane's		497,215
2104 S Main Street - Arby's		485,456
2114 S Main Street - Walmart		1,064,489
11016 Capital Blvd - Golden Corral		584,073
301 S Brooks Street - Town Hall		677,454
12430 Capital Blvd - Wendy's		497,698
TOTAL COST	**$**	**4,944,914**

Impact by Fund		
General Fund	$	1,081,224
Electric Fund (WF Power)		3,863,690
	$	**4,944,914**

RESOLUTION 2023-xx

RESOLUTION AUTHORIZING PURCHASE OF GENERATION SYSTEMS
FROM POWER SECURE, INC.
TOWN OF WAKE FOREST, NORTH CAROLINA

WHEREAS the Town of Wake Forest sent out request for bids pursuant to North Carolina General Statute 143-129; and

WHEREAS the Town of Wake Forest received one bid from Power Secure, Inc. to replace eight (8) generators at various locations; and

WHEREAS the Town of Wake Forest can control electric loads during times of peak demand on the system using generation systems. Wake Forest Power utilizing generators can reduce wholesale power purchases, save money and resources for the Town; and

BE IT RESOLVED by the Board of Commissioners of the Town of Wake Forest authorizes the purchase of the replacement generators from Power Secure, Inc. in the amount of $4,944,914. The Town Manager and Assistant Town Manager/CFO are hereby authorized to execute documents and take other such actions as may be advisable in connection with this purchase.

Duly adopted this 19th day of December 2023.

_____
Vivian A. Jones
Mayor

(ATTEST)

_____
Theresa Savary
Town Clerk

Bid #003-2023 Response

Generator Replacement for

The Town of Wake Forest

Wake Forest Power
Wake Forest, North Carolina

TOWN of
WAKE FOREST

PowerSecure
Hometown Connections | Partner

December 7, 2023

PowerSecure, Inc
4068 Stirrup Creek Dr
Durham, NC 27703

PowerSecure
Hometown Connections | Partner

Cover Letter

December 7, 2023

Brandon Douglas, PE

Booth & Associates, Inc

2300 Rexwoods Drive

Raleigh NC, 27607

Ref: Bid #003-2023 Response - Generator Replacement for The Town of Wake Forest

Dear Mr. Douglas,

PowerSecure, Inc. ("**PowerSecure**") is pleased to submit a revised formal bid response to perform generator replacement for The Town of Wake Forest at eight (8) facilities considering Eatery 1 & 2 as a single system. Based on recent conversation with The Town of Wake Forest, PowerSecure has removed the PURPA system from the Walmart site.

PowerSecure understands the economic value to The Town of Wake Forest of having the generator systems operating as soon as possible. If PowerSecure is awarded the bid, we anticipate having the generators fully commissioned within the timeframe allotted.

PowerSecure is a leading provider of innovative energy solutions to electric utilities and their industrial, institutional, and commercial customers. With more than 2.8GW of generation deployed and actively managed across 2,400 sites, PowerSecure is recognized by GTM Research as "the largest commercial Microgrid developer" in the United States.

We appreciate the importance of this initiative to your company and welcome the opportunity to work together on this project.

Sincerely yours,

For and on behalf of PowerSecure, Inc.



Robert Tugwell
Vice-President Public Utilities

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BID FORM

Generator Replacement
Project

The undersigned bidder affirms and declares that he has carefully examined all bidding documents and Instructions to Bidders which are acknowledged to be a part of this bid, and agrees to provide all labor, materials, equipment, supervision, permits; abide by all local, state and federal laws, rules, regulations, and ordinances applicable to perform the work listed in the specifications and scope of work for the following sum to wit:

TOTAL BASE BID – Lump Sum

Four Million Nine Hundred Forty-Four Thousand Nine Hundred Fourteen Dollars and Eight Cents $ 4,944,914.08

Construction Duration from NTP Approximately 10 months per project location

Address technical questions about the project to Brandon Douglas, PE (Brandon.Douglas@booth-assoc.com)

ITEM 1 – Scope of Project

Provide and install a fully engineered Generation System solution for the Wake Forest Public Works at various locations within the town of Wake Forest. The Generation System shall comprise switchgear, diesel (unless otherwise specified) power generation units, synchronization control systems and accessories, as well as technical advice, assistance, and training to the Wake Forest Public Works operations. The successful Bidder should be able to integrate in the Wake Forest Public Works supply chain in a value-added manner beyond simple sale of generator sets and accessories, enabling the Wake Forest Public Works to reduce the response time for required generator sets deliveries, while maintaining a defined maximum lead time for delivery of standard orders and providing comprehensive after sales services. The Bidder will be responsible for the removal and disposal of all existing equipment.

ITEM 2 – Addendums

All Addendums must be acknowledged in order for the bid to be considered.

Addendum #1 N/A

Addendum #2 N/A

Addendum #3 N/A

The Town of Wake Forest intends to award a contract to the overall lowest responsible, responsive bidder taking into consideration quality, performance, and the time specified in this bid. The Town of Wake Forest reserves the right to reject or all bids and to make the award as deemed in the best interest of the Town of Wake
Forest.

All bidders MUST complete and submit with their bid the enclosed Non-Collusion Affidavit of Prime Bidder

PowerSecure
Hometown Connections | Partner

SIGNATURE PAGE

The undersigned certifies that they have read and understood all the provided bidding documents, the project specifications, and agree to the terms and conditions stated herein.

This bid must be signed by a responsible official of the bidding organization and notarized.

October 9, 2023 **(Company Seal)**

Date

PowerSecure, Inc

Company

PowerSecure, Inc. CORPORATE SEAL 2000 DELAWARE

Authorized Signature

EIN-84-1557738
Federal Identification #

Stephen B. Larson - Sr. Vice-President
Printed Name and Title

Stephen.larson@powersecure.com
Email Address

4068 Stirrup Creek Drive
Street Mailing Address

Durham, NC, 27703
City, State, Zip Code

L.68467 General Contracting
D-0223 - Engineering
U.23794 – Electrical Contracting
Contractor's NC License No.

(919) 632-9010
Telephone Number

On this day of October 9th, 2023, before me Stephen B. Larson (name) appeared and, being duly sworn, did execute the foregoing proposal, and did so state that he/ was properly authorized by Power Secure, Inc. (name of company) to execute the proposal and did so on his/her free act and deed.

Notary Public: Mun Yew Lee Umstead My Commission Expires: June 19, 2027

Mun Yew Lee Umstead

(Seal)

MUN YEW LEE UMSTEAD My Commission Expires NOTARY PUBLIC June 19, 2027 WAKE COUNTY, NC

PowerSecure
Hometown Connections | Partner

Non-Collusion Affidavit of Prime Bidder

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

State of North Carolina

County of Wake

Project: GENERATOR REPLACEMENT FOR THE TOWN OF WAKE FOREST BID# 003-2023

Stephen B. Larson, being first duly sworn, deposes and says that:

1. He is (owner, partner, officer, representative or agent) of PowerSecure, Inc, the Bidder that has submitted the attached Bid;

2. He is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such Bid;

3. Such Bid is genuine and is not a collusive or sham Bid;

4. Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this Affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bids of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Town of Wake Forest or any person interested in the proposed Contract; and

5. The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees or parties in interest, including this Affiant.

Stephen. B Larson — Name

Sr. Vice-President — Title

Subscribed and Sworn to before me this 9th Day of October, 2023

Notary Public: Mun Yew Lee Umstead
Mun Yew Lee Umstead

(Seal)

MUN YEW LEE UMSTEAD
NOTARY PUBLIC
My Commission Expires June 19, 2027
WAKE COUNTY, NC

My Commission Expires: June 19, 2027

Affidavit B – Intent to Perform Contract with Own Workforce

Town of Wake Forest --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce

County of Wake

Affidavit of PowerSecure, Inc
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the GENERATOR REPLACEMENT FOR THE TOWN OF WAKE FOREST BID# 003-2023 Contract
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type of project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: October 9, 2023 Name of Authorized Officer: Stephen B. Larson

(Seal) PowerSecure, Inc CORPORATE SEAL 2000 DELAWARE

Signature: Stephen B. Larson

Title: Sr. Vice-President

State of North Carolina County of Wake

Subscribed and sworn to before me this 9th day of October, 2023

Notary Public Mun Yew Lee Umstead Mun Yew Lee Umstead

My Commission Expires: June 19, 2027

MUN YEW LEE UMSTEAD My Commission Expires NOTARY PUBLIC June 19, 2027 WAKE COUNTY, NC

Affidavit – E-Verify

STATE OF NORTH CAROLINA

AFFIDAVIT

TOWN OF WAKE FOREST

I, Stephen B. Larson (the individual attesting below), being duly authorized by and on behalf of PowerSecure (the entity bidding on project hereinafter "Employer")

after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).

2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E- Verify in accordance with NCGS§64-26(a).

3. Employer is a person, business entity, or other organization that transacts business in this State and that employs 25 or more employees in this State. (mark Yes or No)

a. YES __X__, or

b. NO _____

4. Employer's subcontractors comply with E-Verify, and if Employer is the winning bidder on this project Employer will ensure compliance with E-Verify by any subcontractors subsequently hired by Employer.

This _9_ day of __October__, 2023,

PowerSecure, Inc. CORPORATE SEAL 2000 DELAWARE

Signature of Affiant

Print or Type Name: __Stephen B. Larson__

State of __North Carolina__ County of ___Wake_

(Affix Seal)

Signed and sworn to (or affirmed) before me, this the

9th day of October, 2023

My Commission Expires:

June 19, 2027 Mun Yew Lee Umstead

Notary Public

Mun Yew Lee Umstead

MUN YEW LEE UMSTEAD My Commission Expires NOTARY PUBLIC June 19, 2027 WAKE COUNTY, NC

PowerSecure
Hometown Connections | Partner

E-589 CI - Affidavit of Capital Improvement

NCDOR
Web-Fill
7-18

E-589CI
Affidavit of Capital Improvement

Form E-589CI, Affidavit of Capital Improvement, may be used to substantiate that a contract, or a portion of work to be performed to fulfill a contract, is to be taxed for sales and use tax purposes, as a real property contract for a capital improvement to real property.

The receipt of an affidavit of capital improvement for services to real property, absent fraud or other egregious activities, establishes that the subcontractor or other person receiving the affidavit should treat the transaction as a real property contract for sales and use tax purposes.

A real property contract is a contract between a real property contractor and another person to perform a capital improvement to real property.

Section I. Single Use *(Complete this section to issue the affidavit for a single capital improvement.)*

A
Owner, Lessee/Tenant, or Real Property Contractor
TOWN OF WAKE FOREST
Address
301 S. BROOKS STREET
City WAKE FOREST **State** NC **Zip Code** 27587

B
Real Property Contractor *(General Contractor or Subcontractor)* *Hired to perform capital improvement*
PowerSecure, Inc
Address
4068 Stirrup Creek Drive
City Durham **State** NC **Zip Code** 27703

Describe capital improvement to be performed:

Provide and install a fully engineered Generation System solution for the Wake Forest Public Works at various locations within the town of Wake Forest.

Project Name
Generator Replacement for The Town of Wake Forest

Project Address (where the work is to be performed) | **City** | **State** | **Zip Code**
Multiple locations | Wake Forest | NC | Multiple

I certify that, to the best of my knowledge, this affidavit is accurate and complete and that the transaction described to be performed by the Real Property Contractor (General Contractor or Subcontractor identified in box "B") shall be treated as a real property contract for a capital improvement to real property for sales and use tax purposes. I understand that if it is determined that I issued this affidavit in error and the transaction is subject to sales tax as a retail sale of repair, maintenance, and installation services to real property, I will be liable for payment of any additional taxes determined to be due.

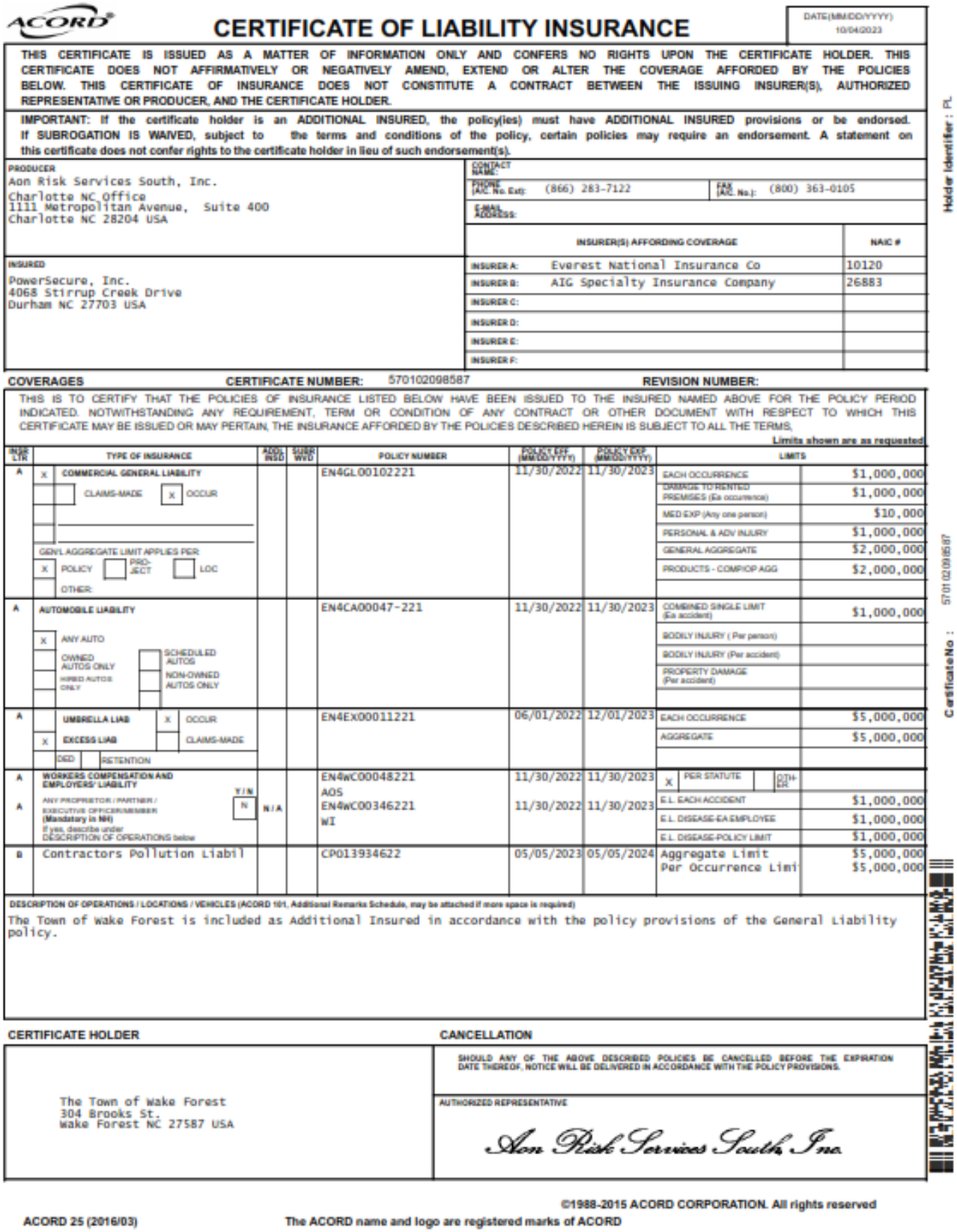
Signature of Authorized Person: _____ Title: Sr. Vice-President Date: 10-09-2023

Section II. Blanket Use *(Complete this section to execute a blanket affidavit for capital improvements.)*

PowerSecure

Hometown Connections | Partner

Certificate of Insurance



ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE(MM/DD/YYYY) 10/04/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Aon Risk Services South, Inc.
Charlotte NC Office
1111 Metropolitan Avenue, Suite 400
Charlotte NC 28204 USA

CONTACT NAME:
PHONE (A/C, No, Ext): (866) 283-7122 FAX (A/C, No.): (800) 363-0105
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE		NAIC #
INSURER A:	Everest National Insurance Co	10120
INSURER B:	AIG Specialty Insurance Company	26883
INSURER C:		
INSURER D:		
INSURER E:		
INSURER F:		

INSURED
PowerSecure, Inc.
4068 Stirrup Creek Drive
Durham NC 27703 USA

COVERAGES CERTIFICATE NUMBER: 570102098587 REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS,

Limits shown are as requested

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE / X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY / PRO-JECT / LOC OTHER:			EN4GL00102221	11/30/2022	11/30/2023	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$1,000,000 $1,000,000 $10,000 $1,000,000 $2,000,000 $2,000,000
A	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY / SCHEDULED AUTOS HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY			EN4CA00047-221	11/30/2022	11/30/2023	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$1,000,000
A	UMBRELLA LIAB / X OCCUR X EXCESS LIAB / CLAIMS-MADE DED / RETENTION			EN4EX00011221	06/01/2022	12/01/2023	EACH OCCURRENCE AGGREGATE	$5,000,000 $5,000,000
A A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR / PARTNER / EXECUTIVE OFFICER/MEMBER (Mandatory in NH) Y/N: N If yes, describe under DESCRIPTION OF OPERATIONS below	N/A		EN4WC00048221 AOS EN4WC00346221 WI	11/30/2022 11/30/2022	11/30/2023 11/30/2023	X PER STATUTE / OTH-ER E.L. EACH ACCIDENT E.L. DISEASE-EA EMPLOYEE E.L. DISEASE-POLICY LIMIT	$1,000,000 $1,000,000 $1,000,000
B	Contractors Pollution Liabil			CP013934622	05/05/2023	05/05/2024	Aggregate Limit Per Occurrence Limi	$5,000,000 $5,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
The Town of Wake Forest is included as Additional Insured in accordance with the policy provisions of the General Liability policy.

CERTIFICATE HOLDER
The Town of Wake Forest
304 Brooks St.
Wake Forest NC 27587 USA

CANCELLATION
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE
Aon Risk Services South, Inc.

Holder Identifier : PL
CertificateNo : 570102098587

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PowerSecure

Hometown Connections | Partner

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 10/4/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Betsy Beck
CAC Specialty 250 Fillmore, Suite 450 Denver, CO 80206	PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS: betsy.beck@cacspecialty.com
www.cacspecialty.com	INSURER(S) AFFORDING COVERAGE / NAIC #
INSURED Southern PowerSecure Holdings, Inc. 4068 Stirrup Creek Dr Durham NC 27703	INSURER A : Evanston Insurance Company 35378 INSURER B : INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** 76694878 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	COMMERCIAL GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ CLAIMS-MADE ☐ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
							MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$
	OTHER:							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ONLY ☐ NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						☐ PER STATUTE ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? ☐ (Mandatory in NH)	N / A					E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
A	Primary E&O Liability			MKLV7PL0005837	5/5/2023	5/5/2024	Limit $1,000,000	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER

The Town of Wake Forest
304 Brooks St.
Wake Forest NC 27587

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Lisa Woodson

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Form of Proposal

WAKE FORETS POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

FORM OF PROPOSAL

*(Provide **one** original and **one** copy)*

Respectfully submitted this 10 *day of* October, *2023*

OWNER:	**BIDDER:**
Wake Forest Power 234 Friendship Chapel Road Wake Forest, NC 27587	PowerSecure, Inc
	NAME: Stephen B. Larson TITLE: Sr. Vice-President
	STREET ADDRESS: 4068 Stirrup Creek Dr
Jeremy Vargo Purchasing Manager Phone: (919) 919-761-3056 Office: (919) 435-9573 **jvargo@wakeforestnc.gov**	CITY/STATE/ZIP: Durham, North Carolina, 27703
	PHONE: (919)-632-9010
	FAX:
	E-MAIL: info@powersecure.com / rtugwell@powersecure.com
SUPPLIER OF PROPOSED EQUIPMENT	SIGNATURE:
MANUFACTURER PowerSecure, Inc	
STREET ADDRESS 4068 Stirrup Creek Dr	
CITY / STATE / ZIP Durham, North Carolina, 27703	

PowerSecure
Hometown Connections | Partner

BID SCHEDULES

BID SHEDULE NO 1 – **"234 Friendship Chapel – Public Works Operations Center"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5-year complete warranty.	1	**$** 236,715.73	**$** 236,715.73
System Construction/Installation	1	**$**151,670.59	**$**151,670.59
Removal of Equipment	1	**$**15,384.20	**$**15,384.20
Additional warranty (10-year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 403,770.52**	**$ 403,770.52**
Sales Tax (If Applicable)	1	**$ Not Included**	**$ Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* Number of consecutive calendar days after receipt of written order from the Owner.
** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(Additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

Public Works Operations Center

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
    - ✓ Complete, submit and coordinate all interconnection applications and activities with Customer's utility.
    - ✓ Provide all engineering and design services necessary to complete construction drawings for the equipment listed in the Equipment Deliverables table below in accordance with the AHJ codes and ordinances.
    - ✓ Prepare 60%, 90% and 100% construction drawings.
    - ✓ Construction drawings signed and sealed by a Registered Professional Engineer of Record (in state of project location) where required.
    - ✓ Prepare product engineering drawings and compile drawings and product information into submittal for Customer review and approval as required.

- **Procurement and Production Services**
  - Procure, manufacture, integrate, assemble, and test System components.

- **Construction Services**
  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

- **Testing and Commissioning**
  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	Gillette Volvo Engine Generator System, 300kW Standby, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated,WP1, SA Level 2, UL142 Sub-Base Fuel Tank, Basler package included.
002	GC - Panel	1	Gen Control Panel
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.
9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases

by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

BID SCHEDULES

BID SHEDULE NO 1 – **"2101 S Main Street – Eatery 1 and Eatery 2"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5-year complete warranty.	1	**$** 381,851.28	**$** 381,851.28
System Construction/Installation	1	$337,522.80	$337,522.80
Removal of Equipment	1	$ 15,384.20	$15,384.20
Additional warranty (10-year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 734,758.28**	**$ 734,758.28**
Sales Tax (If Applicable)	1	**$ Not Included**	**$ Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**

* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(Additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

Eatery 1 and Eatery 2

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
    - ✓ Complete, submit and coordinate all interconnection applications and activities with Customer's utility.
    - ✓ Provide all engineering and design services necessary to complete construction drawings for the equipment listed in the Equipment Deliverables table below in accordance with the AHJ codes and ordinances.
    - ✓ Prepare 60%, 90% and 100% construction drawings.
    - ✓ Construction drawings signed and sealed by a Registered Professional Engineer of Record (in state of project location) where required.
    - ✓ Prepare product engineering drawings and compile drawings and product information into submittal for Customer review and approval as required.

- **Procurement and Production Services**
  - Procure, manufacture, integrate, assemble, and test System components.

- **Construction Services**
  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

- **Testing and Commissioning**
  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	Gillette Volvo Engine Generator System, 300kW Standby, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated,WP1, SA Level 2, UL142 Sub-Base Fuel Tank, Basler package included.
002	APS-1	1	NexGear -Automatic Switchboard ASB-1 1600A, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, UL891, Front / Rear Access Only
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. New power/controls conductor/conduits (Secondary Feeders, Gen Feeders, Load Feeders)
3. Existing pad removal and full replacement as required.
4. Rigging/Setting of new equipment included.
5. Start Up and Commissioning Services included.
6. Removal and disposal of existing equipment (Salvage yard).
7. Temporary power for new equipment tie-in.
8. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. Freight included as Delivered-at-Place (DAP).
2. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
3. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
4. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
5. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
6. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
7. Project Design Information Design/Build by PowerSecure.

8. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

BID SCHEDULES

BID SHEDULE NO 1 – **"2108 S Main Street – Pat Murnane's"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5 year complete warranty	1	$ 314,352.50	$ 314,352.50
System Construction/Installation	1	$ 167,477.96	$ 167,477.96
Removal of Equipment	1	$15,384.20	$ 15,384.20
Additional warranty (10 year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 497,214.66**	**$ 497,214.66**
Sales Tax (If Applicable)	1	**$ Not Included**	**$ Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**

* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

PowerSecure
Hometown Connections | Partner

Pat Murnane's

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
    - ✓ Complete, submit and coordinate all interconnection applications and activities with Customer's utility.
    - ✓ Provide all engineering and design services necessary to complete construction drawings for the equipment listed in the Equipment Deliverables table below in accordance with the AHJ codes and ordinances.
    - ✓ Prepare 60%, 90% and 100% construction drawings.
    - ✓ Construction drawings signed and sealed by a Registered Professional Engineer of Record (in state of project location) where required.
    - ✓ Prepare product engineering drawings and compile drawings and product information into submittal for Customer review and approval as required.

- **Procurement and Production Services**
  - Procure, manufacture, integrate, assemble, and test System components.

- **Construction Services**
  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

- **Testing and Commissioning**
  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	Gillette Volvo Engine Generator System, 150kW Standby, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated,WP1, SA Level 2, UL142 Sub-Base Fuel Tank, Basler package included.
002	APS-1	1	NexGear -Automatic Switchboard ASB-1 800A, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, UL891, Front / Rear Access Only
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.

9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

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BID SCHEDULES

BID SHEDULE NO 1 – **"2104 S Main Street – Arby's"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5 year complete warranty	1	$303,431.41	$303,431.41
System Construction/Installation	1	$166,640.36	$166,640.36
Removal of Equipment	1	$15,384.20	$15,384.20
Additional warranty (10 year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 485,455.97**	**$485,455.97**
Sales Tax (If Applicable)	1	**$ Not Included**	**$ Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**
* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.
** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

PowerSecure
Hometown Connections | Partner

Arby's

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
    - ✓ Complete, submit and coordinate all interconnection applications and activities with Customer's utility.
    - ✓ Provide all engineering and design services necessary to complete construction drawings for the equipment listed in the Equipment Deliverables table below in accordance with the AHJ codes and ordinances.
    - ✓ Prepare 60%, 90% and 100% construction drawings.
    - ✓ Construction drawings signed and sealed by a Registered Professional Engineer of Record (in state of project location) where required.
    - ✓ Prepare product engineering drawings and compile drawings and product information into submittal for Customer review and approval as required.

- **Procurement and Production Services**
  - Procure, manufacture, integrate, assemble, and test System components.

- **Construction Services**
  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

- **Testing and Commissioning**
  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	Gillette Volvo Engine Generator System, 100kW Standby, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated,WP1, SA Level 2, UL142 Sub-Base Fuel Tank, Basler package included.
002	APS-1	1	NexGear -Automatic Switchboard ASB-1 1600A, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, UL891, Front / Rear Access Only
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.

9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

BID SCHEDULES

BID SHEDULE NO 1 – **"2114 S Main Street - Walmart Store #5254"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5 year complete warranty	1	$ 758,259.10	$ 758,259.10
System Construction/Installation	1	$290,846.16	$290,846.16
Removal of Equipment	1	$15,384.20	$15,384.20
Additional warranty (10 year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 1,064,489.46**	**$ 1,064,489.46**
Sales Tax (If Applicable)	1	**$ Not Included**	**$ Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**

* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

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Walmart Store #5254

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
    - ✓ Complete, submit and coordinate all interconnection applications and activities with Customer's utility.
    - ✓ Provide all engineering and design services necessary to complete construction drawings for the equipment listed in the Equipment Deliverables table below in accordance with the AHJ codes and ordinances.
    - ✓ Prepare 60%, 90% and 100% construction drawings.
    - ✓ Construction drawings signed and sealed by a Registered Professional Engineer of Record (in state of project location) where required.
    - ✓ Prepare product engineering drawings and compile drawings and product information into submittal for Customer review and approval as required.

- **Procurement and Production Services**
  - Procure, manufacture, integrate, assemble, and test System components.

- **Construction Services**
  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

- **Testing and Commissioning**
  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	PowerSecure PowerBlock Engine Generator System, 1250kW Standby, 480/277V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated, WP1, SA Level 2, UL142 Sub-Base Fuel Tank
002	APS-1	1	NexGear -Automatic Switchboard ASB-1 3000A, 480/277V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, UL891, Front / Rear Access Only
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.

9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. PURPA heat recovery is not included.
17. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
18. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
19. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

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BID SCHEDULES

BID SHEDULE NO 1 – **"11016 Capital Blvd - Golden Corral"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5 year complete warranty	1	$394,356.23	$ 394,356.23
System Construction/Installation	1	$174,333.01	$174,333.01
Removal of Equipment	1	$15,384.20	$15,384.20
Additional warranty (10 year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 584,073.44**	**$ 584,073.44**
Sales Tax (If Applicable)	1	**$Not Included**	**$Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**

* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

PowerSecure
Hometown Connections | Partner

Golden Corral

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
    - ✓ Complete, submit and coordinate all interconnection applications and activities with Customer's utility.
    - ✓ Provide all engineering and design services necessary to complete construction drawings for the equipment listed in the Equipment Deliverables table below in accordance with the AHJ codes and ordinances.
    - ✓ Prepare 60%, 90% and 100% construction drawings.
    - ✓ Construction drawings signed and sealed by a Registered Professional Engineer of Record (in state of project location) where required.
    - ✓ Prepare product engineering drawings and compile drawings and product information into submittal for Customer review and approval as required.

- **Procurement and Production Services**
  - Procure, manufacture, integrate, assemble, and test System components.

- **Construction Services**
  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

- **Testing and Commissioning**
  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	Gillette Volvo Engine Generator System, 300kW Standby, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated,WP1, SA Level 2, UL142 Sub-Base Fuel Tank, Basler package included.
002	APS-1	1	NexGear -Automatic Switchboard ASB-1 1600A, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, UL891, Front / Rear Access Only
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.

9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

BID SCHEDULES

BID SHEDULE NO 1 – **"301 Brooks Street - Town Hall"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5 year complete warranty	1	$ 470,738.34	$ 470,738.34
System Construction/Installation	1	$ 191,331.35	$ 191,331.35
Removal of Equipment	1	$ 15,384.20	$ 15,384.20
Additional warranty (10 year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 677,453.90**	**$ 677,453.90**
Sales Tax (If Applicable)	1	**$ Not Included**	**$ Not Included**

Delivery Schedule No. 1
Instructions to Bidders, 5. Delivery of Equipment

All bids to be valid for a minimum of 60 days.

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**

* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

Town Hall

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
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  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
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Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.

9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

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3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
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11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

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BID SCHEDULES

BID SHEDULE NO 1 – **"12430 Capital Blvd – Wendy's"**

DESCRIPTION	QUANTITY	UNIT PRICE	TOTALPRICE
Generation System, with Generator and accompanying switchgear, all in accordance with the Specifications, Including 5-year complete warranty	1	$ 314,795.38	$ 314,795.38
System Construction/Installation	1	$ 167,518.30	$ 167,518.30
Removal of Equipment	1	$ 15,384.20	$ 15,384.20
Additional warranty (10 year total)	1	**$ N/A**	**$ N/A**
TOTAL BID:	**1**	**$ 497,697.88**	**$ 497,697.88**
Sales Tax (If Applicable)	1	**$Not Included**	**$ Not Included**

Delivery Schedule No. 1
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	Delivery (Days)*
Approval Drawings	50 Days ARO
Final Drawings**	70 Days ARO
Delivery of Material**	220 Days ARO

* **Estimated working days**

* ~~Number of consecutive calendar days~~ after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

Manufacturer's Field Engineering Services - Schedule No. 1
(additional days over what is included in the Base Bid for training)

Field Service Engineering Rate: $2,684.00 per day

PowerSecure
Hometown Connections | Partner

Wendy's

Proposed Services and Equipment Scope of Work and Deliverables:

PowerSecure will deliver the following solution on a Turnkey basis for the project as outlined below

Services:

- **Project Management Services**
  - PowerSecure will provide Project Management to manage the project plan, schedule, and communications and will coordinate the activities throughout project delivery.
  - PowerSecure's Project Manager will serve as the single point of interface with Customer and Customer's utility and will be present on-site for critical activities and key milestones.

- **Preliminary Design Services**
  - Conduct review of existing Customer's electrical infrastructure and available documents.
  - Confirm project scope and location acceptability with Customer.
  - Conduct preliminary code and environmental review based on project site locale.
  - Provide Customer with concept design documents for approval (30% design drawings).

- **Engineering Services**
  - *PowerSecure Engineer of Record Services*
    - ✓ Conduct civil, electrical, and other related studies and investigations required for project design, permitting, and construction, including utility locator services.
    - ✓ Establish project permitting requirements.
    - ✓ Develop, submit, and coordinate all required permit applications with the appropriate authorities having jurisdiction (AHJ), except as provided below with regards to certain environmental permits to be obtained by Customer.
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    - ✓ Prepare 60%, 90% and 100% construction drawings.
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  - Procure, manufacture, integrate, assemble, and test System components.

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  - Construct and install System components including construction management services, vendor coordination, site work, electrical and mechanical work, general conditions, and system modifications for interconnection with existing infrastructure and utility, and communications systems necessary for a fully functioning System.
  - Prepare and submit to Customer construction progress reports.

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  - Develop plan and verification report for commissioning and testing of System.
  - Commission and test all System components at all levels as needed:
    - ✓ Level 1 – Startup (SU) – During this phase, equipment will be inspected and tested to ensure design and functionality complies with the System, Customer, manufacturer, and contract requirements.
    - ✓ Level 2 – Commissioning (CX) – During this phase, the interaction between all the equipment will be demonstrated to validate under both normal and abnormal conditions of System operation. This will include testing the System with live customer load and will often impact Customer's operations to simulate outage scenarios. PowerSecure will communicate testing expectations and schedules with Customer prior to any testing.
    - ✓ Level 3 – Integrated System Test (IST) – During this phase, PowerSecure will demonstrate the interaction between the building electrical systems with one another under both normal and abnormal operating conditions. Testing is performed to validate site

infrastructure such as chiller plants, air handlers, heating plants, and electrical systems performance. A 3rd party commissioning agent will provide additional test scripts.

- Conduct System function testing per approved sequence of operations (SOO).
- Prepare full System functionality testing and performance verification report, including, but not limited to, communications programming, protocols, and interfacing between all components.
- Conduct acceptance testing of all System components.
- Provide completed Commissioning verification report to Customer.

- **Training**
  - Site Overview: Review all site drawings, including construction drawings, switchgear riser diagrams, and electrical schematics so that the operator is knowledgeable in equipment designations, voltage ratings, and component types within the System. In addition, this training will include an overview on the sequence of operation and common failure scenarios to better equip the operator on how the System responds during different modes of operation.

Deliverable Materials:

Item #	ID	Qty	Description
001	GEN	1	Gillette Volvo Engine Generator System, 150kW Standby, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, T4F Rated,WP1, SA Level 2, UL142 Sub-Base Fuel Tank, Basler package included.
002	APS-1	1	NexGear -Automatic Switchboard ASB-1 800A, 208/120V, 3P, 3Ph, 4W, 65kAIC, Nema 3R, UL891, Front / Rear Access Only
003	RTU Box	1	N3R Enclosure, SEL-RTAC-3505 for Mode Dispatch and Data Aggregation
004	MS	1	9S Socket form Meter Enclosure

Installation Scope Details:

1. Turnkey installation.
2. Pads extensions as required and rigging/setting of new equipment included.
3. Start Up and Commissioning Services included.
4. Removal and disposal of existing equipment (Salvage yard).
5. Temporary power for new equipment tie-in.
6. Includes pulling on new auxiliary power circuits and control wiring in existing conduit as needed.

Clarifications:

1. All existing power wiring shall is planned to be re-used. PowerSecure will perform megger testing to validate conductor insulation integrity prior to final terminations. If any existing conductor is deemed to be at EOL, PS will provide cost for replacement at that time.
2. Freight included as Delivered-at-Place (DAP).
3. This proposal assumes that the site where the new equipment will be installed is a level green field free of trees and any other obstructions.
4. Site conditions are assumed to be suitable at this time for project installation. ** GeoTech Survey is not included. (See Exclusions #3 below.)
5. Commissioning Services: If 100% load is not available during initial Commissioning due to the site not being fully operational PS will require an additional trip(s) at an additional cost for each trip to satisfy the PS Commissioning Standards.
6. Submittal documents will be electronic copies. If hard copy (paper) drawings are needed, they will be an additional $1000 per set.
7. Proposal includes PowerSecure Five-Year Warranty on PowerSecure Equipment.
8. Project Design Information Design/Build by PowerSecure.

9. Escalation. In the event of a delay or significant price increase of material, equipment, labor, or other items necessary for the performance of this Contract through no fault of PowerSecure, the contract price and time for performance under this Contract shall be equitably adjusted by the parties to account for such delay and/or price increase. Changes in the price of material, equipment, labor, and/or other items will be considered significant when the price of any such item increases by 10%, or the aggregate price of multiple items increases by 5%, from the price on the effective date of this Contract. PowerSecure shall provide documentation evidencing such increases or delays and will exercise reasonable commercial efforts to mitigate any price increase or delay.

Exclusions:

1. Site work as it pertains to tree removal, lot clearing, lot leveling or grading of any kind for equipment installation, is not included.
2. Elevated pads or any other provisions for flood zone equipment protection have not been evaluated and are not included.
3. GeoTech Survey and/or any other soil testing needed or required, is not included. ** Site conditions are assumed to be suitable at this time for project installation.
4. Spill Prevention Control Countermeasure (SPCC) Plan if needed, is not included (required to be completed by Owner).
5. System impact studies and/or utility grid modifications are not included.
6. Utility Interconnection fees are not included.
7. Utility Application fees are not included.
8. Utility Transformers are not included.
9. Utility Transformer relocation is not included.
10. Utility Transformer relocation and associated fees are not included.
11. Utility Metering components if needed, are not included. To be provided and installed by others.
12. On-Site Load Bank Testing is not included.
13. Fuel disposal prior to the removal of the existing generators is not included.
14. Fuel for PowerBlock Generator is not included.
15. Environmental Permit Fees are not included.
16. State and Municipal Taxes are not included. (Sales, USE, Privilege, Excise, Import or any other Taxes imposed).
17. Rock/spoiled soils removal/replacement not included. If rock/spoiled soils are encountered during UG work, they will be removed and replaced by Others, or by PowerSecure at an additional cost.
18. This proposal does not include any rework or relocation of any existing underground utilities that may prohibit installation of the new feeders.

SUPPLEMENTARY INFORMATION

Manufacturer and Type: PowerSecure, Inc - Corporation

Place of Manufacture: PowerSecure, Inc's Distributed Infrastructure manufacturing facility in Durham, North Carolina

Nearest Shop Repair Facility: PowerSecure, Inc's Distributed Infrastructure manufacturing facility in Durham, North Carolina

Nearest I&SE Facility: PowerSecure, Inc's Distributed Infrastructure manufacturing facility in Durham, North Carolina

Other Utilities Purchasing Recent Units of Same Design:

American Municipal Power

Town of Clayton

Greenville Utility Commission

Fayetteville Public Works

City of Rocky Mountain

City of Wilson

Arizona Public Service

Method of Shipment:

F.O.B ground

Proposed Shipping Firm: PowerSecure, Inc or one of our carriers partners.

Proposed Rigging Firm: TBD

(Attach separate supplemental sheets if necessary)

- **Please see attached Preliminary Drawing Set**
- **Please see attached Equipment Generic Specifications**
- **Please see attached Maintenance Services Scope and Pricing**
- **Please see attached General Specifications Compliance**

Affidavit of Bidder

AFFIDAVIT OF BIDDER

The final payment of retained amount due the Bidder on account of the Contract shall not become due until the Bidder has furnished to the Owner through the Engineer an affidavit signed, sworn, and notarized to the effect that all payments for Material, services, or any other reason in connection with this Contract have been satisfied and that no claims or liens exist against the Bidder in connection with this Contract. In the event that the Bidder cannot obtain similar affidavits from Subcontractors to protect the Bidder and the Owner from possible liens or claims against the Subcontractor, the Bidder shall state in his affidavit that no claims or liens exist against any Subcontractor, and if any liens or claims appear afterward, the Bidder shall save the Owner harmless on account thereof.

Bidder: PowerSecure, Inc

By: Stephen Larson

Date: October 10, 2023

Form of Exceptions

FORM OF EXCEPTIONS

Instructions to Bidders, Paragraph 2.6 and Section 6. Award of Contract

BIDDER: POWERSECURE, INC.

OWNER: WAKE FOREST POWER

PROJECT DESCRIPTION: GENERATION SYSTEM FOR THE TOWN OF WAKE FOREST

INSTRUCTIONS: The following is a list of exceptions to the Bidding Documents and/or Technical Specifications pertaining to the furnishing of the subject materials. Bidders shall identify each exception by Specification page and paragraph number on this form. The omission of exception implies complete compliance with Plans and Specifications.

BID DOCUMENT/ SPECIFICATION PAGE NO. AND PARAGRAPH	**EXCEPTION/VARIATION**
#0003-2023, pg. 6, ¶6	"The contractor hereby agrees to indemnify the Owner from and against all **third- party** claims, suits, damages, costs, losses and expenses in any manner **to the extent** arising out of ~~or connected with~~ the failure of the contractor, its subcontractors, agents, successors, assigns, officers or employees to comply with the **applicable** provisions of the ADA or rules and regulations thereunder."
#0003-2023, pg. 9, ¶24	"To the extent permitted by law, the Contractor agrees to defend, ~~pay on behalf of~~, indemnify, and hold harmless the Town of Wake Forest, its elected and appointed officials, employees, agents, and volunteers against any and all **third-party** claims, demands, suits or losses, including all **reasonable** costs connectedtherewith, for any damages which may be asserted, claimed or recovered against or from the Town of Wake Forest, its elected or appointed officials, employees, agents, volunteers by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof **to the extent** resulting from the negligence of Contractor. **The Town of Wake Forest agrees to: (i) notify Contractor as soon as becoming aware of any indemnifiable claim, (ii) cooperate with and authorize Contractor to carry out an investigation and defend any such indemnifiable claim, and (iii) not compromise or settle any indemnifiable claims without the prior written consent of Contractor, which consent shall not be unreasonably delayed or withheld. NOTWITHSTANDING ANYTHING CONTAINED HEREIN TO THE CONTRARY, NEITHER CONTRACTOR NOR ITS EMPLOYEES, ITS SUBCONTRACTORS, SUPPLIERS OR OTHER AGENTS SHALL BE LIABLE TO THE TOWN OF WAKE FOREST OR ANY THIRD PARTY FOR ANY LOSS OF USE, LOSS OF REVENUE OR PROFIT, DIMINUTION IN VALUE, OR FOR ANY INDIRECT, SPECIAL, INCIDENTAL, EXEMPLARY, PUNITIVE OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY NATURE ARISING OUT OF OR IN CONNECTION WITH THEIR PERFORMANCE OR NON- PERFORMANCE UNDER THIS PROPOSAL AND ANY RELATED CONTRACT, REGARDLESS OF WHETHER SUCH DAMAGES WERE FORESEEABLE AND WHETHER OR NOT CONTRACTOR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL CONTRACTOR'S AGGREGATE LIABILITY ARISING OUT OF OR IN CONNECTION WITH THE PERFORMANCE OR NON-PERFORMANCE OF THE SERVICES, WORK OR ANY ADDITIONAL WORK OR OTHERWISE UNDER THIS PROPOSAL OR ANY CONTRACT EXCEED THE CONTRACT PRICE."**

#0003-2023, pg. 39, ¶10.1

"Payment by the Owner to the Successful Bidder shall be made ~~through monthly invoices that detail the work completed the previous month. Each invoice amount shall be for the percentage of the project being invoiced less ten percent (10%) for the retainage. The equipment costs less ten percent (10%) retainage shall be included on the invoice once it is installed on site, inspected by the owner, and free of any apparent damage. All labor and equipment invoices will be reviewed by the owner and engineer and determined to be a fair representation of the work completed. The invoices shall be paid once the work is verified to be in compliance with the specifications. Invoices will be reviewed by the Owner and Engineer within thirty (30) days of the invoice receipt.~~ As the delivery milestones listed below are completed, with payments due net 30 days from invoice date.

% of Price	Milestone
30%	Contract Signing
20%	Receipt of System Submittal
20%	Arrival of Major Equipment Onsite
25%	Substantial Completion of Installation/Start-up/Commissioning
5%	Final Completion and Final Acceptance (Completion of agreed-upon punch list / In-Service Training, and O&M Manual / Closeout Package Handover)
100%	Total

#0003-2023, pg. 40, ¶8.2

"If the Bidder is delayed at any time in the progress of the work by any act of negligence by the Owner or the Engineer, by any separate Bidder employed by the Owner, or by changes ordered the work, then the time of completion shall be extended for such reasonable time as the Engineer may decide. **In addition, the compensation payable by Owner to Bidder shall be equitably adjusted to compensate for any verifiable additional costs incurred by Bidder due to any such extension of time."**

#0003-2023, pg. 41, ¶8.3

"Except for an event of Force Majeure (as hereinafter defined), no extension of time for completion will be made for ordinary delays and accidents. Extensions may be granted for delays ordered by the Engineer if the request has been made in writing within forty-eight (48) hours after the **written** order to cease work has been given."

#0003-2023, pg. 41, ¶9.0

"The Bidder shall guarantee his materials and workmanship against defect due to faulty materials or faulty workmanship ~~or negligence~~ for a period of sixty (60) months from energization, or sixty-six (66) months from date of delivery, whichever applies. He shall make good such defective materials or workmanship and any damages resulting there **from** without cost to Owner. **This guarantee is contingent on Owner purchasing additional operations and maintenance services from Contractor upon pricing to be quoted separately**." ~~Bidder shall submit an additional price for the Owner to optionally extend the warranty an additional (60) months,~~

#0003-2023, pg. 42,¶14.0

"The Bidder shall hold harmless and indemnify the Owner, its agents, and employees from any and all **third-party** claims, suits, proceedings for infringement of any patent or patents covering materials and equipment purchased hereunder. The Bidder shall defend any **third-party** suit or proceeding brought against Owner, its agents, or employees based upon a claim that the materials and equipment, or any part thereof, constitute an infringement of any patent; or if the Bidder shall fail to defend such suit or proceeding, Owner may do so and the Bidder shall make reimbursement for the **reasonable** expense of such litigation. If the materials and equipment, or any part thereof, are held to constitute infringement and the use thereof is enjoined, the Bidder shall, at its own expense, either procure for Owner the right to continue to use the materials and equipment, or such part thereof, or shall replace the materials and equipment, or such part thereof, with non-infringing materials and equipment."

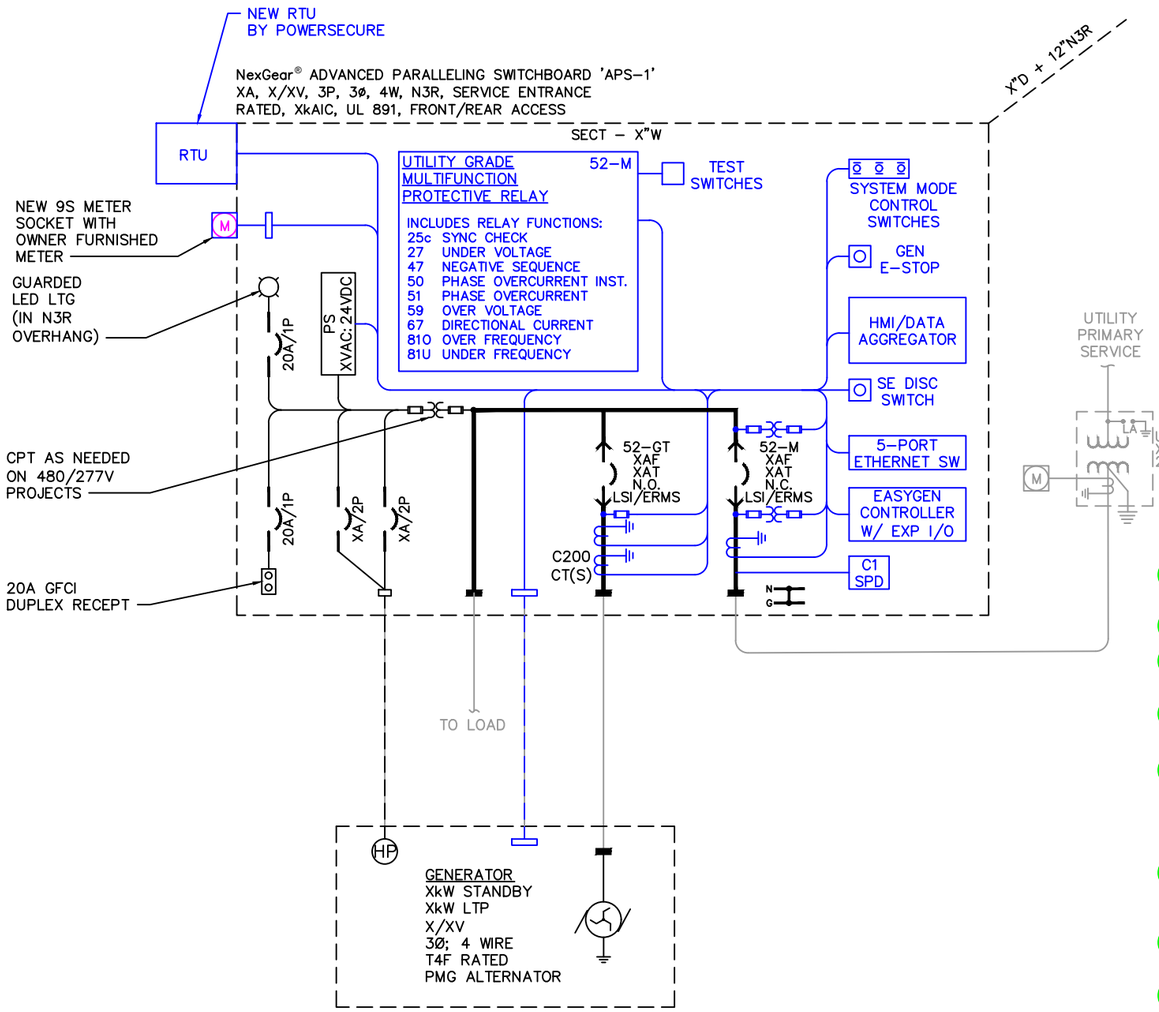
#0003-2023, pg. 58, ¶2.6.1

"All relays and controllers shall have standard factory software and programming. **~~There shall be no proprietary software or functions inside of controllers.~~"**

#0003-2023, pg. 59, ¶4.2	"The materials and equipment furnished hereunder shall become the property of the Owner with the completion of the construction, commissioning, and final acceptance of the installation by the **O**wner~~,~~ ~~provided, however, that.~~ **T**he **O**wner may reject any such materials and equipment as does not comply with the Specifications for materials and equipment and warranties of the Bidder and manufacturers **at the time of delivery**." **Any subsequent claim of defective materials or equipment shall be subject to Bidder's warranty in General Conditions, Section 9.0 above.** ~~Recognition and subsequent rejection of any defective materials and equipment may occur either before or after incorporation of such materials and equipment into the facilities; provided such rejection is made within one (1) year from date of delivery of the materials and equipment. Upon any such rejection, the Bidder shall replace the rejected materials and equipment with materials and equipment complying with the Specifications for materials and equipment and warranties, F.O.B. truck at a suitable destination. The Owner shall return the rejected materials F.O.B. truck at the same destination. In the event of the failure of the Bidder to so replace rejected materials and equipment, the Owner may make such replacement and the cost and expense thereof shall be paid by and recoverable from the Bidder.~~"
#0003-2023, pg. 59, ¶4.3.1	"The Bidder shall hold harmless and indemnify the Owner, its agents, and employees, from any and all **third-party** claims, suits and proceedings for infringement of any patent or patents covering materials and equipment purchased hereunder. The Bidder shall defend any **third-party** suit or proceeding brought against the Owner, its agents or employees, based upon a claim that the materials and equipment or any part thereof constitutes an infringement of any patent, or if the Bidder shall fail to defend such suit or proceeding, the Owner may do so and the Bidder shall make reimbursement for the **reasonable** expense of such litigation. If the materials and equipment, or any part thereof is enjoined, the Bidder shall, at its own expense, either procure for the Owner the right to continue to use the materials and equipment, or such part thereof, or shall replace the materials and equipment, or such part thereof, with non-infringing materials and equipment. **Notwithstanding the foregoing, Bidder may comply with this paragraph by pass-through indemnification by the manufacturer.**"
Add new section	**"Force Majeure: Notwithstanding anything contained in this Proposal or any related contract to the contrary, in no event shall Contractor be liable or responsible to Owner or any third party for any damages arising out of, nor shall Contractor be deemed to have breached or defaulted due to, any failure or hinderance to perform or delay due to any cause, act or circumstance beyond Contractor's reasonable control, including without limitation, acts of God, flood, fire, earthquake, explosion, governmental actions or inactions, war, invasion or hostilities (whether war is declared or not), terrorist threats or acts, riot, or other civil unrest, national emergency, revolution, insurrection, pandemic, epidemic, lock-outs, strikes or other labor disputes, or restraints or delays affecting carriers, or inability or delay in obtaining supplies of adequate or suitable materials or equipment, or utility, power or cellular or telephone service quality or disruption ("Force Majeure"). In such event, Contractor shall be entitled to an extension of time as necessary to overcome the cause of the failure or hinderance to perform or delay, and if applicable reasonable and verifiable costs directly attributable to the Force Majeure event, either or both of which shall be as mutually agreed."**
Add new section	**"The Bidder's pricing herein is contingent and based upon providing all nine (9) sites, and Bidder reserves the right to amend pricing per site should Owner award Bidder less than all nine (9) sites"**

Preliminary Drawing Set

Location	Modes	Main Size & Position	Gen Tie Size & Position	Existing Dims (WxDxH)	New Dims (WxDxH)	Ampacity	Voltage	AIC	Existing/New Gen Size	Gen Type	Peak Load (kW)	PURPA	OG Job #	Notes
Arbys	Standby/LMM/LCM	1600AF/600AT (Left)	1600A/400AT (Right)	45"x48+12"x90"	50"x48+12"x90"	600A	208/120V	65kAIC	100kW (100kW)	Volvo (Buyout)	~47kW	N	NG1180	U/G Max Lug Height - 33", Load Max Lug Heigh - 23"
Pat Murames	Standby/LMM/LCM	800AF/800AT (Left)	800AF/600AT (Right)	45"x48+12"x90"	50"x48+12"x90"	800A	208/120V	65kAIC	135kW (150kW)	Volvo (Buyout)	~86kW	N	NG1181	U/G Max Lug Height - 33", Load Max Lug Heigh - 23"
Walmart	Standby/LMM/LCM	3000AF/3000AT (Right)	3000AF/2500AT (Left)	45"x60+12"x90"	50"x60+12"x90"	3000A	480/277V	65kAIC	1400kW (1250kW)	Volvo (PS Make)	~744kW	N	NG1066	U/G/Load Max Lug Height - 28", Ground Source GF (Both Breakers), LS-5 Design
Flavor District	Standby/LMM/LCM	1600AF/1200AT (Left)	1600A/1200AT (Right)	45"x48+12"x90"	50"x48+12"x90"	1200A	208/120V	65kAIC	300kW (300kW)	Volvo (Buyout)	Unknown	N	NG1228	U/G Max Lug Height - 33", Load Max Lug Heigh - 23", Gen Battery Onboard APS
Eatery 1 & 2	Standby/LMM/LCM	1600AF/800AT (Right)	1600A/1200AT (Left)	45"x48+12"x90"	50"x48+12"x90"	800A	208/120V	65kAIC	300kW (150kWx2)	Volvo (Buyout)	~150kW	N	NG1179	U/G/Load Max Lug Height - 29"
Wendys	Standby/LMM/LCM	800AF/800AT (Left)	800AF/800AT (Right)	45"x48+12"x90"	50"x48+12"x90"	800A	208/120V	65kAIC	150kW (150kW)	Volvo (Buyout)	~80kW	N	NG1705	U/G/Load Max Lug Height - 23"
Town Hall	Standby/LCM	1200AF/1200AT	800AF/600AT	45"x60"+12"x90"	50"x60+12"x90"	1200A	480/277V	65kAIC	400kW (600kW)	Volvo (Buyout)	Unknown	N	NG2689	Need Info
Public Works	Standby/LMM/LCM	ATS	ATS	41"x47"x95.5"	N/A	1200A	208/120V	65kAIC	276kW (300kW)	Volvo (Buyout)	Unknown	N	By Others	Replace existing ASCO ATS controller with new Group G Controller



RELAY SETTINGS FOR UTILITY MAIN 52-M
PU BASED ON CT RATIO AND NOMINAL VOLTAGE OF 120V
50 - See TCC
51 - See TCC
81O- 60.5 for 0.07 sec
81U- 59.5 for 0.07 sec
27-(1) 0.88pu for 1.9 sec
27-(2) 0.5pu for 0.07 sec
59-(1) 1.1pu for 0.9 sec
59-(2) 1.2pu for 0.07 sec
47- 0.9pu for 1.9 sec
25- 3%V 10° 1Hz Live Util Dead Bus
67- 1.1pu for 0.07 sec

Updated: 7.26.2022

KEY NOTES:

1. ADDITIONAL ITEMS WITH APS ARE AS FOLLOWS: CT SHORTING TERMINAL BLOCKS, TERMINAL BLOCKS, ETC.
2. GEN MONITORING: MATCH EXISTING COMMS/HARD–WIRED MONITORING
3. ACTIVE BREAKERS SHALL HAVE 24VDC CHARGE/TRIP/CLOSE/AUX CONTACTS/BELL ALARM LOCKOUT ACCESORIES
4. ERMS ACTIVATION IS LOCAL USING BREAKER INTERFACE (BREAKERS GREATER THAN OR EQUAL TO 1200A)
5. RTU WILL BE A MAX 24X24X16 N3R ENCLOSURE AND WILL UTILIZE AN SEL–RTAC–3505 FOR (3) COMMS MODE DISPATCH SIGNAL INPUTS (LOAD CURTAILMENT, LOAD MGMT PROCESS, LOAD MGMT BASELOAD) AND (10) DNP3 SYSTEM MONITORING POINTS (TBD), CELL MODEM & SERVICE FURNISHED BY ToWF AND INSTALLED BY PS
6. SYSTEM CONTROL SWITCHES SHALL BE AS FOLLOWS:
   –SYSTEM CONTROL SWITCH: AUTO/OFF/RUN/ONLINE
   –MODE SWITCH: BASELOAD/LOAD FOLLOW/ISOLATE
7. SEL UTILITY INTERTIE RELAY & WOODWARD ENGINE CONTROLLERS (SPEC REQUIREMENT)
8. VOLTAGE SENSING TYPE (PTS/FUSED) BASED ON SYSTEM VOLTAGE (SHOWN AS PTS FOR REFERENCE ONLY)
9. ALL GENS TO BE NAMEPLATED AT THEIR CONTINUOUS DUTY RATING
10. GEN OUTPUT METERING SHALL BE REVENUE GRADE ACCURACY (0.3%)
11. PROVIDE SPECIAL APS ANCHORING GUSSETS OFFSET FROM CORNERS TO PREVENT EXISTNG PADS ANCHORING POINTS BEING TOO CLOSE TO EDGE

LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS

SYSTEM DATA	
– PEAK LOAD: SEE CHART	
FAULT CURRENT CALCULATIONS	
UTILITY (SEC) –	IscAIC
GENERATOR(S) –	IscAIC
MAX –	IscMAX
Y	INFINITE BUS METHOD USED
EOR DATA	
EOR FIRM:	POWERSECURE
Y	SHORT CIRCUIT ANALYSIS
Y	COORDINATION STUDY
Y	ARC FLASH ANALYSIS
CODE DATA	
UTILITY NAME:	WAKE FOREST POWER
2020	CURRENT NEC ADHERENCE
115	DESIGN WIND SPEEDS (MPH)
387	PROJECT ELEVATION (FT)
N/A	PEAK dBA AT PROPERTY LINE
N/A	UTILITY REQ. WITNESS TEST
N	NFPA 110 LOADS
N	FIRE PUMP LOADS
GENERATOR DATA & MODES	
142	FUEL TANK (UL142 / UL2085)
Y	MANUAL STANDBY
Y	AUTOMATIC STANDBY
Y	LOAD MANAGEMENT
Y	LOAD CURTAILMENT
N	EXTENDED OUTAGE
SYSTEM MODE(S) OF OPERATION	
N	OPEN TRANSITION
N	CLOSED TRANSITION (ms)
N	SOFT LOAD TRANSFER
Y	LONG TERM PARALLEL
N	LOAD SHED REQUIRED

GENERAL NOTES

- (9) SITES INCLUDED
- TURNKEY SCOPE
- CIVIL ENGINEERING AS NEEDED SHALL BE INCLUDED IN SCOPE
- (5) YEAR WARRANTY
- PERMITTING SHALL BE BY OTHERS (AIR/TANK/AHJ)
- SPARE PARTS PER SYSTEM: (1) TUBE CONTACT LUBRICANT, (1) CONTAINER TOUCH UP PAINT, (4) REPLACEMENT FUSES FOR EACH SIZE/TYPE
- (1) DAY ONSITE TRAINING FOR SITE VARIATIONS
- SYSTEM SHALL CONTAIN BOTH PROCESS AND BASELOAD CAPABILITIES (EXPORT)
- ALL EXISTING POWER FEEDERS SHALL REMAIN AS EXISTING BUT SHALL BE HIPOT TESTED FOR INTEGRITY
- TEMP POWER TO BE INCLUDED FOR TIE–INS DUE TO REFRIGERATION
- (5) COPIES HARD COPY O&M(S)

TOWN of WAKE FOREST

PowerSecure
4068 Stirrup Creek Drive
Durham, NC 27703
1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ELECTRICAL DISTRIBUTION DIAGRAM
PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E2a

Plot Date12/7/2023

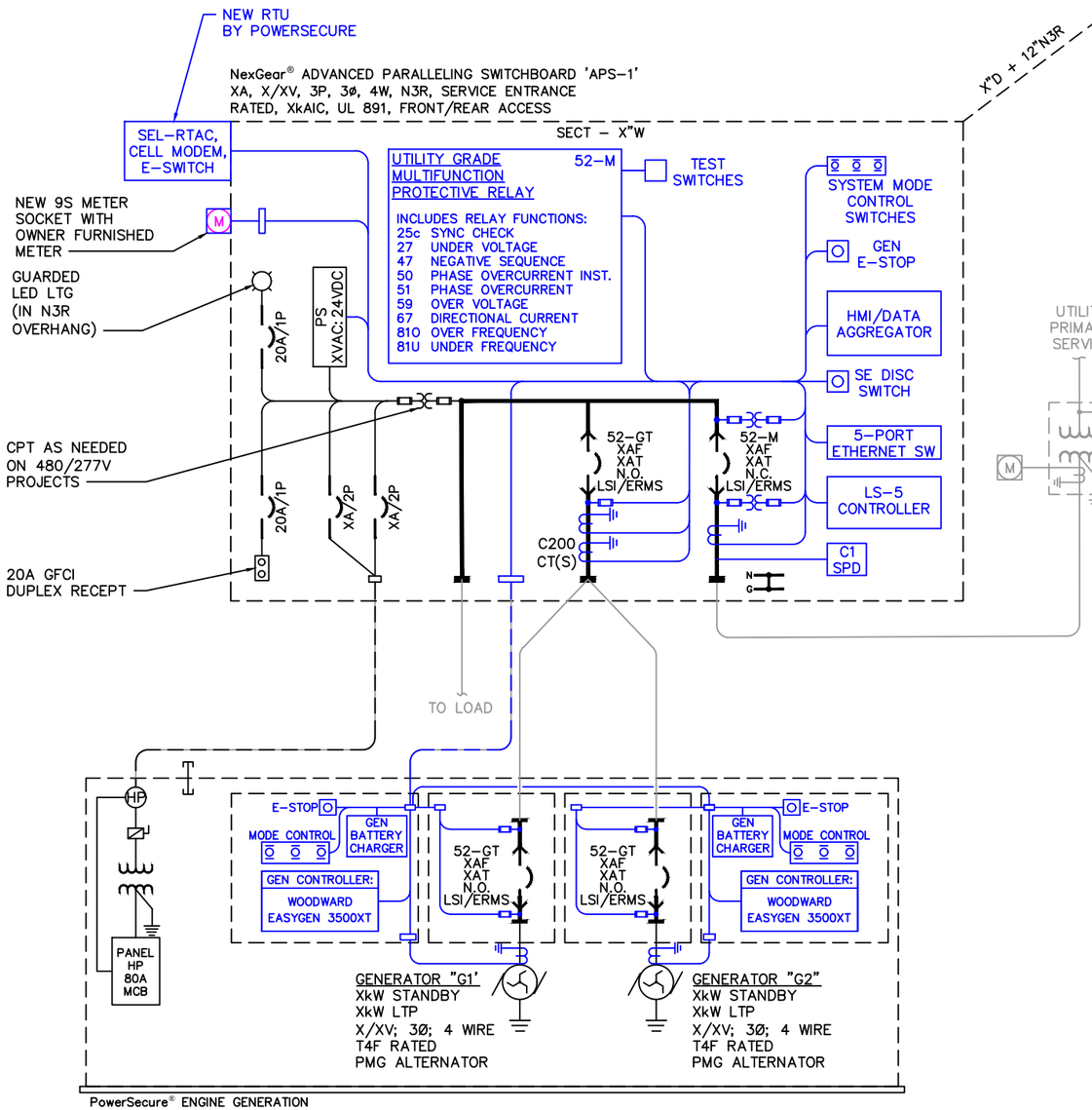
ELECTRICAL DISTRIBUTION DIAGRAM

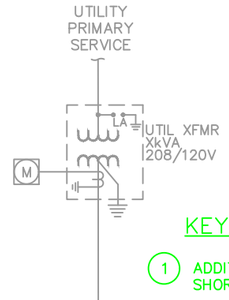
No Scale

CONFIDENTIAL & PROPRIETARY

PRELIMINARY NOT FOR CONSTRUCTION

Location	Modes	Main Size & Position	Gen Tie Size & Position	Existing Dims (WxDxH)	New Dims (WxDxH)	Ampacity	Voltage	AIC	Existing/New Gen Size	Gen Type	Peak Load (kW)	PURPA	OG Job #	Notes
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Eatery 1 & 2	Standby/LMM/LCM	1600AF/800AT (Right)	1600A/1200AT (Left)	45"x48+12"x90"	50"x48+12"x90"	800A	208/120V	65kAIC	300kW (150kWx2)	Volvo (Buyout)	~150kW	N	NG1179	U/G/Load Max Lug Height - 29"
Wendys	Standby/LMM/LCM	800AF/800AT (Left)	800AF/800AT (Right)	45"x48+12"x90"	50"x48+12"x90"	800A	208/120V	65kAIC	150kW (150kW)	Volvo (Buyout)	~80kW	N	NG1705	U/G/Load Max Lug Height - 23"
Town Hall	Standby/LCM	1200AF/1200AT	800AF/600AT	45"x60"+12"x90"	50"x60+12"x90"	1200A	480/277V	65kAIC	400kW (600kW)	Volvo (Buyout)	Unknown	N	NG2689	Need Info
Public Works	Standby/LMM/LCM	ATS	ATS	41"x47"x95.5"	N/A	1200A	208/120V	65kAIC	276kW (300kW)	Volvo (Buyout)	Unknown	N	By Others	Replace existing ASCO ATS controller with new Group G Controller





RELAY SETTINGS FOR UTILITY MAIN 52-M
PU BASED ON CT RATIO AND NOMINAL VOLTAGE OF 120V
50 - See TCC
51 - See TCC
81O- 60.5 for 0.07 sec
81U- 59.5 for 0.07 sec
27-(1) 0.88pu for 1.9 sec
27-(2) 0.5pu for 0.07 sec
59-(1) 1.1pu for 0.9 sec
59-(2) 1.2pu for 0.07 sec
47- 0.9pu for 1.9 sec
25- 3%V 10° 1Hz Live Util Dead Bus
67- 1.1pu for 0.07 sec

Updated: 7.26.2022

KEY NOTES:

1. ADDITIONAL ITEMS WITH APS ARE AS FOLLOWS: CT SHORTING TERMINAL BLOCKS, TERMINAL BLOCKS, ETC.
2. GEN MONITORING: MATCH EXISTING COMMS/HARD-WIRED MONITORING
3. ACTIVE BREAKERS SHALL HAVE 24VDC CHARGE/TRIP/CLOSE/AUX CONTACTS/BELL ALARM LOCKOUT ACCESORIES
4. ERMS ACTIVATION IS LOCAL USING BREAKER INTERFACE (BREAKERS GREATER THAN OR EQUAL TO 1200A)
5. RTU WILL BE A MAX 24X24X16 N3R ENCLOSURE AND WILL UTILIZE AN SEL-RTAC-3505 FOR (3) COMMS MODE DISPATCH SIGNAL INPUTS (LOAD CURTAILMENT, LOAD MGMT PROCESS, LOAD MGMT BASELOAD) AND (10) DNP3 SYSTEM MONITORING POINTS (TBD), CELL MODEM & SERVICE FURNISHED BY ToWF AND INSTALLED BY PS
6. SYSTEM CONTROL SWITCHES SHALL BE AS FOLLOWS:
   -SYSTEM CONTROL SWITCH: AUTO/OFF/RUN/ONLINE
   -MODE SWITCH: BASELOAD/LOAD FOLLOW/ISOLATE
7. SEL UTILITY INTERTIE RELAY & LS-5/WOODWARD ENGINE CONTROLLERS (SPEC REQUIREMENT)
8. VOLTAGE SENSING TYPE (PTS/FUSED) BASED ON SYSTEM VOLTAGE (SHOWN AS PTS FOR REFERENCE ONLY)
9. ALL GENS TO BE NAMEPLATED AT THEIR CONTINUOUS DUTY RATING
10. GEN OUTPUT METERING SHALL BE REVENUE GRADE ACCURACY (0.3%)
11. PROVIDE SPECIAL APS ANCHORING GUSSETS OFFSET FROM CORNERS TO PREVENT EXISTNG PADS ANCHORING POINTS BEING TOO CLOSE TO EDGE

LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS

SYSTEM DATA	
– PEAK LOAD: SEE CHART	
FAULT CURRENT CALCULATIONS	
UTILITY (SEC) –	IscAIC
GENERATOR(S) –	IscAIC
MAX –	IscMAX
Y	INFINITE BUS METHOD USED
EOR DATA	
EOR FIRM:	POWERSECURE
Y	SHORT CIRCUIT ANALYSIS
Y	COORDINATION STUDY
Y	ARC FLASH ANALYSIS
CODE DATA	
UTILITY NAME:	WAKE FOREST POWER
2020	CURRENT NEC ADHERENCE
115	DESIGN WIND SPEEDS (MPH)
387	PROJECT ELEVATION (FT)
N/A	PEAK dBA AT PROPERTY LINE
N/A	UTILITY REQ. WITNESS TEST
N	NFPA 110 LOADS
N	FIRE PUMP LOADS
GENERATOR DATA & MODES	
142	FUEL TANK (UL142 / UL2085)
Y	MANUAL STANDBY
Y	AUTOMATIC STANDBY
Y	LOAD MANAGEMENT
Y	LOAD CURTAILMENT
N	EXTENDED OUTAGE
SYSTEM MODE(S) OF OPERATION	
N	OPEN TRANSITION
N	CLOSED TRANSITION (ms)
N	SOFT LOAD TRANSFER
Y	LONG TERM PARALLEL
N	LOAD SHED REQUIRED

GENERAL NOTES

-(9) SITES INCLUDED
-TURNKEY SCOPE
-CIVIL ENGINEERING AS NEEDED SHALL BE INCLUDED IN SCOPE
-(5) YEAR WARRANTY
-PERMITTING SHALL BE BY OTHERS (AIR/TANK/AHJ)
-SPARE PARTS PER SYSTEM: (1) TUBE CONTACT LUBRICANT, (1) CONTAINER TOUCH UP PAINT, (4) REPLACEMENT FUSES FOR EACH SIZE/TYPE
-(1) DAY ONSITE TRAINING FOR SITE VARIATIONS
-SYSTEM SHALL CONTAIN BOTH PROCESS AND BASELOAD CAPABILITIES (EXPORT)
-ALL EXISTING POWER FEEDERS SHALL REMAIN AS EXISTING BUT SHALL BE HIPOT TESTED FOR INTEGRITY
-TEMP POWER TO BE INCLUDED FOR TIE-INS DUE TO REFRIGERATION
-(5) COPIES HARD COPY O&M(S)

TOWN of WAKE FOREST

PowerSecure
4068 Stirrup Creek Drive
Durham, NC 27703
1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ELECTRICAL DISTRIBUTION DIAGRAM
PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E2b

ELECTRICAL DISTRIBUTION DIAGRAM

No Scale

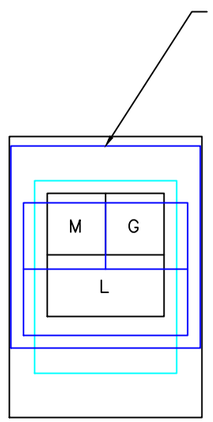
CONFIDENTIAL & PROPRIETARY

PRELIMINARY NOT FOR CONSTRUCTION

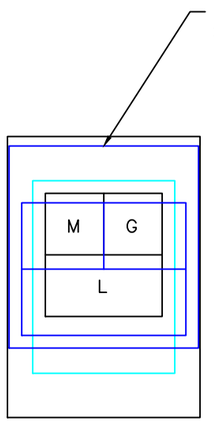
Plot Date:12/7/2023

LEGEND

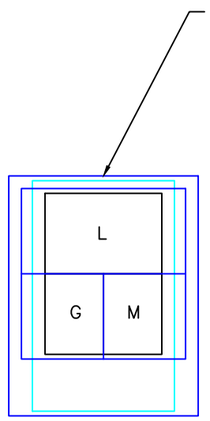
- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS



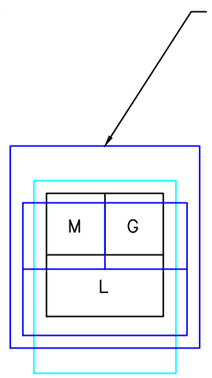
ARBY'S



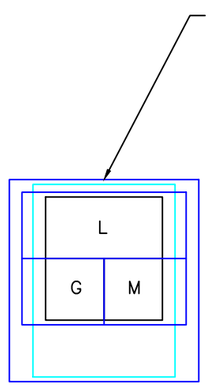
PAT MURNANE'S



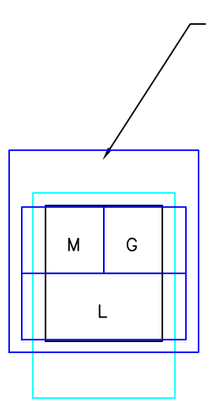
WALMART



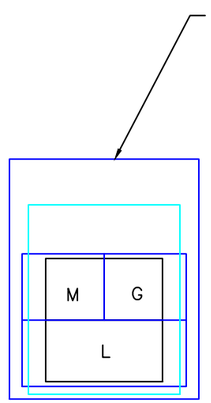
GOLDEN CORRAL



EATERY 1&2



WENDY'S



TOWN HALL

PUBLIC WORKS

ATS GROUP G CONTROLLER REPLACEMENT ONLY (LEAVE EXISTING ASCO ATS)

PAD DETAILS

1/4" = 1'-0"

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TOWN of WAKE FOREST

PowerSecure
4068 Stirrup Creek Drive
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1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db

CHK'D BY:

TITLE: SYSTEM DETAILS

PROJECT: Distributed Infrastructure System®

DATE: Dec. 7, 2023

E3

Plot Date:12/7/2023



VIEW "A"

ENLARGED PARTIAL SITE PLAN - ARBY'S

1/8" = 1'-0"

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REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure System®

DATE: Dec. 7, 2023

E3a

Plot Date:12/7/2023



LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS

SCOPE OF WORK:
- REMOVE AND DISPOSE OF EXISTING APS
- SEE E2 FOR PAD EXTENSION REQUIREMENTS (IF REQ)
- RIGGING, SETTING & TERMINATION OF NEW APS
- REMOVE AND DISPOSE OF EXISTING GENERATOR (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- RIGGING, SETTING & TERMINATION OF NEW GENERATOR
- GENERATOR PAD EXTENSION REQUIRED FOR STUB AREA ALIGNMENT
- ALL CONTROL & POWER CONDUITS EXISTING
- START-UP & COMMISSIONING
- MONITORING IS NOT INCLUDED
- PS TO PROVIDE AND INSTALL GEN OUTPUT METER SOCKET METER & RTU
- ALL PERMITTING BY OTHERS

VIEW "A"

ENLARGED PARTIAL SITE PLAN - PAT MURANES

1/8" = 1'-0"

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TOWN of WAKE FOREST

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REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3b

Plot Date:12/7/2023

SCOPE OF WORK:
- REMOVE AND DISPOSE OF EXISTING APS
- SEE E2 FOR PAD EXTENSION REQUIREMENTS (IF REQ)
- RIGGING, SETTING & TERMINATION OF NEW APS
- REMOVE AND DISPOSE OF EXISTING GENERATOR (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- RIGGING, SETTING & TERMINATION OF NEW GENERATOR
- GENERATOR PAD EXTENSION REQUIRED FOR STUB AREA ALIGNMENT
- ALL CONTROL & POWER CONDUITS EXISTING
- EXTEND GEN POWER/CONTROL CONDUITS FOR NEW GEN STUB-UP LOCATIONS (NEW 2000A/5W CONDUCTOR)
- START-UP & COMMISSIONING
- MONITORING IS NOT INCLUDED
- PS TO PROVIDE AND INSTALL GEN OUTPUT METER SOCKET METER & RTU
- DEMOLISH EXISTING PURPA SYSTEM
- ALL PERMITTING BY OTHERS

LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS



VIEW "A"

ENLARGED PARTIAL SITE PLAN - WALMART

1/8" = 1'-0"

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TOWN of WAKE FOREST

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REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3c

Plot Date:12/7/2023



LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS

SCOPE OF WORK:
- REMOVE AND DISPOSE OF EXISTING APS
- SEE E2 FOR PAD EXTENSION REQUIREMENTS (IF REQ)
- RIGGING, SETTING & TERMINATION OF NEW APS
- REMOVE AND DISPOSE OF EXISTING GENERATOR (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- RIGGING, SETTING & TERMINATION OF NEW GENERATOR
- ALL CONTROL & POWER CONDUITS EXISTING
- START-UP & COMMISSIONING
- MONITORING IS NOT INCLUDED
- PS TO PROVIDE AND INSTALL GEN OUTPUT METER SOCKET METER & RTU
- ALL PERMITTING BY OTHERS

VIEW "A"

ENLARGED PARTIAL SITE PLAN - FLAVOR DISTRICT

1/8" = 1'-0"

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TOWN of WAKE FOREST

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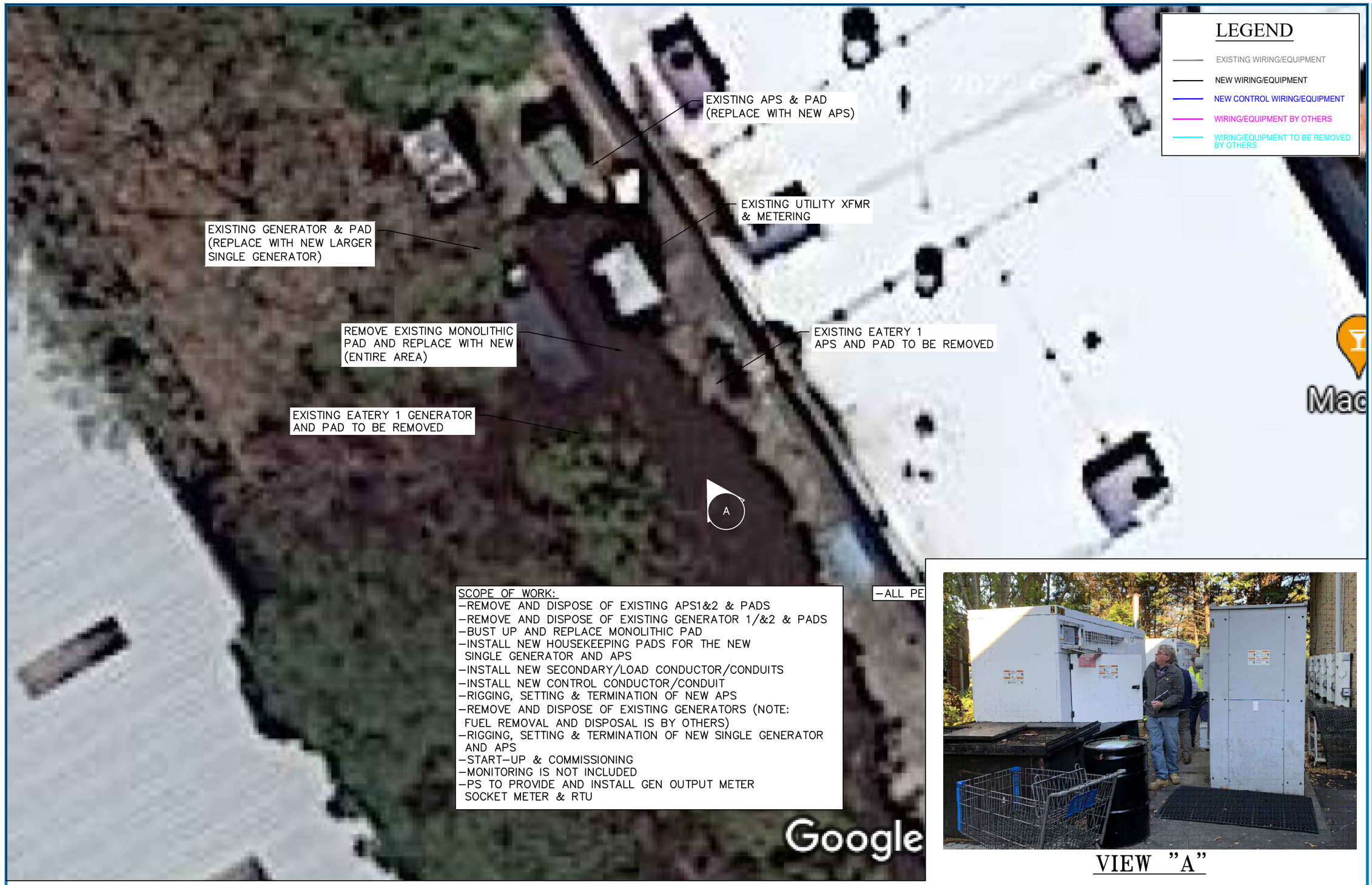
TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3d

Plot Date:12/7/2023



SCOPE OF WORK:
- –REMOVE AND DISPOSE OF EXISTING APS1&2 & PADS
- –REMOVE AND DISPOSE OF EXISTING GENERATOR 1/&2 & PADS
- –BUST UP AND REPLACE MONOLITHIC PAD
- –INSTALL NEW HOUSEKEEPING PADS FOR THE NEW SINGLE GENERATOR AND APS
- –INSTALL NEW SECONDARY/LOAD CONDUCTOR/CONDUITS
- –INSTALL NEW CONTROL CONDUCTOR/CONDUIT
- –RIGGING, SETTING & TERMINATION OF NEW APS
- –REMOVE AND DISPOSE OF EXISTING GENERATORS (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- –RIGGING, SETTING & TERMINATION OF NEW SINGLE GENERATOR AND APS
- –START–UP & COMMISSIONING
- –MONITORING IS NOT INCLUDED
- –PS TO PROVIDE AND INSTALL GEN OUTPUT METER SOCKET METER & RTU

–ALL PE

VIEW "A"

ENLARGED PARTIAL SITE PLAN – EATERY 1&2

1/8" = 1'–0"

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TOWN of WAKE FOREST

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1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db CHK'D BY:

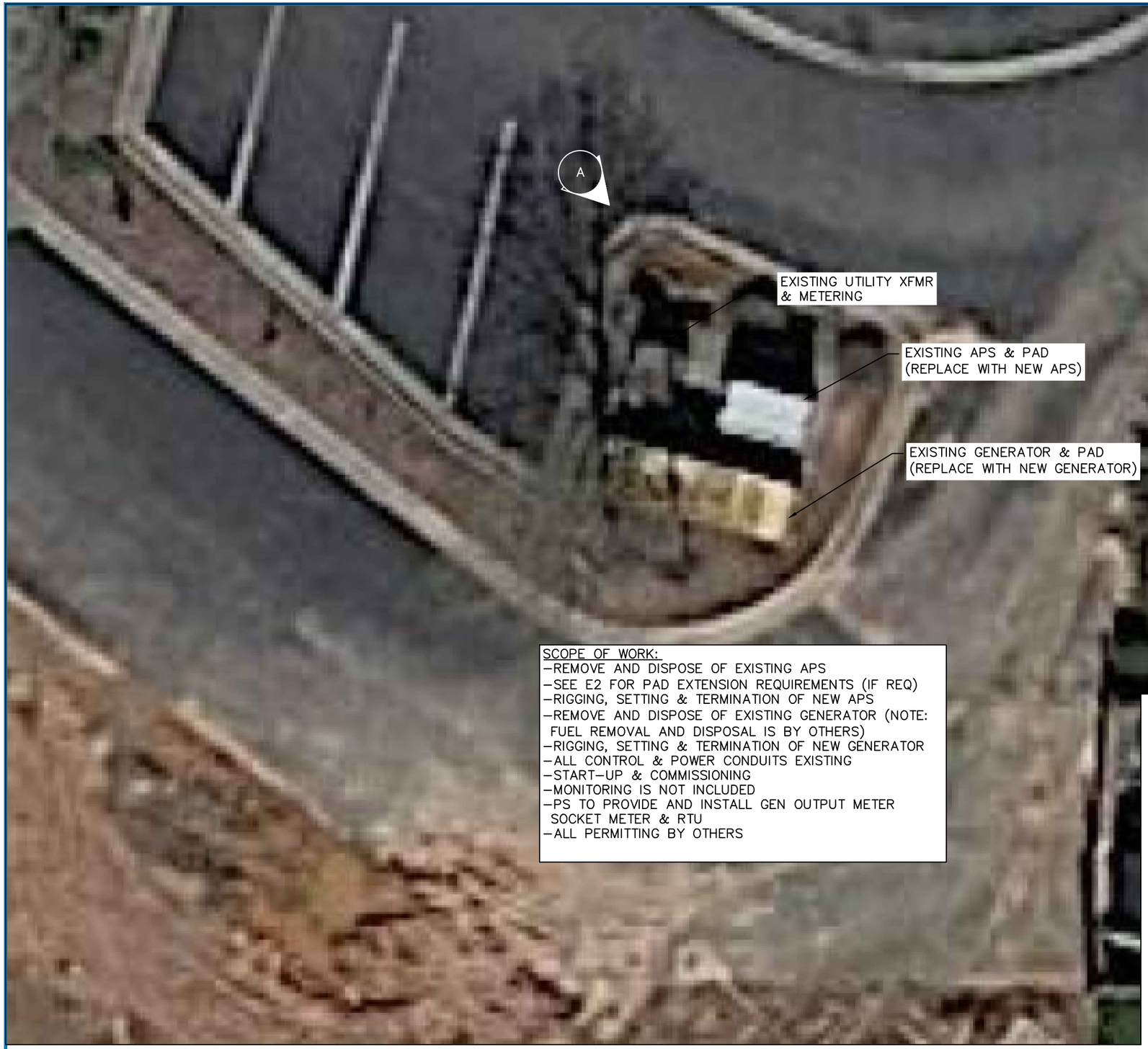
TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3ef

Plot Date:12/7/2023



LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS

SCOPE OF WORK:
- REMOVE AND DISPOSE OF EXISTING APS
- SEE E2 FOR PAD EXTENSION REQUIREMENTS (IF REQ)
- RIGGING, SETTING & TERMINATION OF NEW APS
- REMOVE AND DISPOSE OF EXISTING GENERATOR (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- RIGGING, SETTING & TERMINATION OF NEW GENERATOR
- ALL CONTROL & POWER CONDUITS EXISTING
- START-UP & COMMISSIONING
- MONITORING IS NOT INCLUDED
- PS TO PROVIDE AND INSTALL GEN OUTPUT METER SOCKET METER & RTU
- ALL PERMITTING BY OTHERS



VIEW "A"

ENLARGED PARTIAL SITE PLAN - WENDYS

1/8" = 1'-0"

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TOWN of WAKE FOREST

PowerSecure
4068 Stirrup Creek Drive
Durham, NC 27703
1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3g

Plot Date:12/7/2023



SCOPE OF WORK:
- REMOVE AND DISPOSE OF EXISTING APS
- SEE E2 FOR PAD EXTENSION REQUIREMENTS (IF REQ)
- RIGGING, SETTING & TERMINATION OF NEW APS
- REMOVE AND DISPOSE OF EXISTING GENERATOR (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- RIGGING, SETTING & TERMINATION OF NEW GENERATOR
- ALL CONTROL & POWER CONDUITS EXISTING
- START-UP & COMMISSIONING
- MONITORING IS NOT INCLUDED
- PS TO PROVIDE AND INSTALL GEN OUTPUT METER SOCKET METER & RTU
- ALL PERMITTING BY OTHERS

VIEW "A"

ENLARGED PARTIAL SITE PLAN - TOWN HALL

1/8" = 1'-0"

CONFIDENTIAL & PROPRIETARY

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TOWN of WAKE FOREST

PowerSecure
4068 Stirrup Creek Drive
Durham, NC 27703
1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3h

Plot Date: 12/7/2023



SCOPE OF WORK:
- REMOVE AND DISPOSE OF EXISTING GEN/FUEL TANK
- SEE E2 FOR PAD EXTENSION REQUIREMENTS (IF REQ)
- RIGGING, SETTING & TERMINATION OF NEW APS
- REMOVE AND DISPOSE OF EXISTING GENERATOR (NOTE: FUEL REMOVAL AND DISPOSAL IS BY OTHERS)
- RIGGING, SETTING & TERMINATION OF NEW GENERATOR
- ALL CONTROL & POWER CONDUITS EXISTING
- REPLACE ATS CONTROLLER WITH NEW GROUP G CONTROLLER (PROGRAM FOR NORMAL SINGLE PHASE PROTECTION)
- START-UP & COMMISSIONING
- MONITORING IS NOT INCLUDED
- ALL PERMITTING BY OTHERS

LEGEND

- EXISTING WIRING/EQUIPMENT
- NEW WIRING/EQUIPMENT
- NEW CONTROL WIRING/EQUIPMENT
- WIRING/EQUIPMENT BY OTHERS
- WIRING/EQUIPMENT TO BE REMOVED BY OTHERS





VIEWS

TOWN of WAKE FOREST

PowerSecure
4068 Stirrup Creek Drive
Durham, NC 27703
1-866-DG-SKILL

REV.	DATE	DESCRIPTION

DR BY: db
CHK'D BY:

TITLE: ENLARGED PARTIAL SITE PLAN

PROJECT: Distributed Infrastructure® System

DATE: Dec. 7, 2023

E3i

ENLARGED PARTIAL SITE PLAN - PUBLIC WORKS

1/8" = 1'-0"

CONFIDENTIAL & PROPRIETARY

PRELIMINARY NOT FOR CONSTRUCTION

Plot Date:12/7/2023

Maintenance Services Scope and Pricing

PowerSecure will provide Maintenance Services as provided herein for the System upon Start-Up Date. PowerSecure will provide these services during normal working hours of 8:00 AM – 4:00 PM, Monday through Friday, unless otherwise specified. PM1 (Minor), and PM2 (Major) services include a comprehensive technical inspection of all items as outlined below, in compliance with NFPA 110. The PM2 (Major) service includes replacement of engine oil, oil filters, fuel filters and water filters, as required by the manufacturer. Air Filters and other replacement parts are NOT Included in any PM pricing.

Service Notes:

* Any additional time on site waiting for site contact or site entrance will be billed at the hourly rate.
* If the equipment is not available for service at the scheduled time, Customer will be billed time and travel costs.
* Racor Filters or any additional fuel filters for add on Fuel Filtration Systems are not included in PM pricing.
* If Customer requires any work to be done energized, then a second tech will be required, and the cost of the job will be increased.
* If fuel, oil or other materials prices rise, we reserve the right to adjust pricing accordingly.
* ATS & Load Bank testing assumes they will be performed with one of the Generator PM Services or may be subject to an additional trip charge.
* All pricing assumes the generators are no more than 480 Volts and are located at ground level with available parking for PowerSecure's service vehicle within 50 ft. of the generator unit. If any assumption is not correct, PowerSecure reserves the right to adjust pricing.
* Pursuant to recent changes in many state fire protection laws, and to comply with applicable law, PS requires Customer to have your licensed fire protection system contractor present for all service and will only service the fire pump under the direct supervision of your licensed contractor. Any delays in service will be the responsibility of Customer and will result in a labor charge, a trip charge, and a potential delay in service due to rescheduling.
* PS highly recommends that: (1) generators be load tested annually for 2 to 4 consecutive hours at loads at or greater than 75% of rated capacity; and (2) annually samples of oil, coolant, and diesel fuel be collected and sent to an independent laboratory for evaluation.

1. **Generators**

A. 6 Month Preventive Maintenance (PM) Services – Minor Inspection

1. Pre-Run Checks
   - 1.1 Check for and Log Faults
   - 1.2 Take Generator Out of Auto
   - 1.3 Check Jacket Water Heater operation and Thermostat setting.
   - 1.4 Check Jacket Water Heater connections.
   - 1.5 Check oil level, top off & record amount added (up to 2 gallons included)
   - 1.6 Check coolant level, top off & record amount added (up to 1 gallon included)
   - 1.7 Check coolant freeze protection concentration and record level.
   - 1.8 Check DEF concentration level (if accessible), record level.
   - 1.9 Check Belts and Accessories
   - 1.10 Visually inspect Water Pump and Hoses
   - 1.11 Visually inspect Radiator and Shrouds
   - 1.12 Visually inspect Starter connections
   - 1.13 Check Battery Acid Specific Gravity & record, top off (as needed)
   - 1.14 Visually inspect and clean Batteries and connections
   - 1.15 Check Battery Charger Operation & Float/Equalize Function, record.
   - 1.16 Check for oil leaks.
   - 1.17 Check for coolant leaks.
   - 1.18 Check for fuel leaks.
   - 1.19 Check for DEF leaks (diesel units only)
   - 1.20 Check Main Tank level & manually stick Tank to check for water contamination via water finding paste (if applicable)
   - 1.21 Check Day Tank operation (if applicable)
   - 1.22 Visually inspect Fuel Separator/drain water (if applicable)
   - 1.23 Visually inspect Governor linkage, if applicable
   - 1.24 Visually inspect Ignition System (gas units only)
   - 1.25 Visually Inspect Generator & Windings
   - 1.26 Visually inspect Air Filter, Seals, and Piping
   - 1.27 Visually inspect Exhaust System

1.28 Visually inspect Louvers for damage, hardware, or alignment issues

2. Running Checks
   - 2.1 Start System
   - 2.2 Check Louver operation.
   - 2.3 Check Exhaust System for leaks and damage.
   - 2.4 Perform walk-around Inspection.
   - 2.5 Check gauges & note readings.
   - 2.6 Check for unusual noises or vibration.
   - 2.7 Check for applicable Shutdowns, Alarms and Warnings operation.
   - 2.8 Check Voltage and Frequency, adjust as needed.
   - 2.9 Connect to Electronic Control Module (ECM) and perform log tests, applicable updates, etc.
   - 2.10 Record Following Information after Equipment reaches proper operating temperature:
     - 2.10.1 AC Volts
     - 2.10.2 Frequency (Hz)
     - 2.10.3 kW
     - 2.10.4 Oil PSI
     - 2.10.5 Coolant Temperature
     - 2.10.6 Alternator Volts
     - 2.10.7 Alternator Amps
     - 2.10.8 Fuel PSI, if applicable
     - 2.10.9 Record all System deficiencies & recommendations.

3. Final Inspection
   - 3.1 Perform walk-around Inspection.
   - 3.2 Note any problems or needed repairs.
   - 3.3 Check for leaks.
   - 3.4 Ensure System is in Auto with no faults.
   - 3.5 Ensure System Breakers are in the proper position.
   - 3.6 Verify monitoring sees system online and all faults cleared.

B. **12 Month Preventive Maintenance (PM) Services – Major Inspection**

In addition to the 6 Month PM Services, the following will be performed at 12 Months:

- 1.1 Change Oil and Filters
- 1.2 Change Fuel Filters (if applicable)
- 1.3 Clean/Replace Water Separator (if applicable)
- 1.4 Visually inspect rotating rectifier assembly (if applicable)
- 1.5 Lube generator bearings (if applicable)
- 1.6 Visually inspect main conductors for loose connections
- 1.7 Grease Fan Hub Bearings (if applicable)
- 1.8 Obtain coolant and oil sample.

2. Switchgear

A. **<u>Low Voltage</u> (LV) Switchgear Maintenance Service - PowerBlock® and Standalone (600 VAC or less)**

1.0 Annual Visual and Mechanical Inspection (12 Month Inspection – <u>without</u> power interruption)

- 1.1 Document equipment nameplate data on the test report.
- 1.2 Inspect the physical, electrical, and mechanical condition of the equipment and all components.
- 1.3 Confirm that lubricants have been correctly applied at the manufacturer's recommended locations.
- 1.4 Verify appropriate anchorage, required area clearances, physical damage, and correct alignment and cleanliness.
- 1.5 Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.
- 1.6 Perform visual inspections on instrument transformers (if accessible).
- 1.7 Inspect all mechanical indicating devices for correct operation.
- 1.8 Verify that filters are in place and/or vents are clear.
- 1.9 Inspect control power transformers (if accessible).
- 1.10 Inspect relays and cases for physical damage and perform infrared scan of accessible current.

Pricing including all nine (9) sites:

Year	Annual Maintenance Services
1	$32,470.00
2	$33,444.00
3	$34,447.00
4	$35,481.00
5	$36,545.00

The Ongoing Services fees above include escalation at three percent (3%). In the event that the latest available Producer Price Index (PPI) for final demand, 12-month percent change, not seasonally adjusted published on the Bureau of Labor Statistics website exceeds three percent (3%) then the amount by which PPI exceeds three percent (3%) would be equitably applied to adjust the above fees. After the Initial Term, the fees for the Ongoing Services shall escalate annually at the greater of three percent (3%) or the latest available PPI for final demand, 12-month percent change, not seasonally adjusted published on the Bureau of Labor Statistics website.

Non-Routine Additional Maintenance Services:

2023 Scheduled Service Hourly Rates:	
Standard Labor, M-F 8:00 AM to 4:00 PM	$165.00
Overtime Labor, M-F 12:00 AM to 7:59 AM and 4:01 PM to 11:59 PM / Saturday	$247.50
Sunday/Holiday/Disasters or Emergencies (4-hour Minimum Onsite Charges Apply)	$330.00
Trip Charge (round-trip)	$375.00
2023 Emergency Service Hourly Rates (4-hour Minimum Onsite Charges Apply):	
Same Day On-Site Response – Standard Hours (M-F 8:00 AM – 4:00 PM)	$247.50
Same Day On-Site Response – Non-Standard Hours	$330.00
Service During Natural Disasters and Government Declared State of Emergencies	$330.00
Trip Charge (round-trip)	$450.00
2023 Optional Fluid Samples	
Oil – O1D	$65.00
Coolant – C1	$75.00
Fuel – F1	$280.00

*Parts not included in hourly rates and are billed at standard rates. If the term of this agreement is greater than one year, the above fees are based upon current market pricing and shall escalate annually at the greater of three percent (3%) or the latest available Producer Price Index (PPI) for final demand, 12-month percent change, not seasonally adjusted published on the Bureau of Labor Statistics website.

General Specifications Compliance

Subject: ToWF Generator Replacement RFB - C/D/E Specification Compliance
Date: 10/05/23
By: Dusty Belk

Legend:
C=Compliance
D=Deviation
E=Exception

2.2.1 Deviation: Permitting is not included (Air, Tank, AHJ)
2.4.2.1 Deviation: The SEL-700G is a generator protective relay and we utilize the woodward controller for those functions. The typical intertie relay utilized is an SEL-700GT (Very similar functions without touchscreen)
1.1.7 Exception: Draw-out circuit breaker can't be accomodated for these retrofit replacements and would require different footprints that would not mate up with existing stub-up areas.
1.6.2 Woodward terminals only accept up to #14 Awg.
1.6.10 Deviation: We use equivalent GE IKU terminal blocks.
1.6.11 Deviation: We use equivalent GE IKU terminal blocks.
1.8.1 Exception: PTs will not be draw-out type on this UL891 gear.
2.2.5 Exception: No audible alarm provided for Fuel system
2.2.6 Exception: No audible alarm provided for DEF system

Ex "E" See exhibit for nominal gen node sizing variations

4.1.3 Deviation: Both process and baseload (Export) modes will be able capable both locally and remote via the RTU

Additional RFP compliance:

2.C Exception: All initial fuel and DEF filling shall be by ToWF (Terms & Conditions)

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS FOR A GENERATION SYSTEM FOR THE TOWN OF WAKE FOREST

GENERAL SPECIFICATIONS

C 1.0 Scope of Work

C 1.1 Provide and install a fully engineered Generation System solution for the Wake Forest Public Works at various locations within the town of Wake Forest. The Generation System shall comprise switchgear, diesel (unless otherwise specified) power generation units, synchronization control systems and accessories, as well as technical advice, assistance, and training to the Wake Forest Public Works operations. The successful Bidder should be able to integrate in the Wake Forest Public Works supply chain in a value-added manner beyond simple sale of generator sets and accessories, enabling the Wake Forest Public Works to reduce the response time for required generator sets deliveries, while maintaining a defined maximum lead time for delivery of standard orders and providing comprehensive after sales services. The Bidder will be responsible for the removal and disposal of all existing equipment.

C 2.0 Project Background and Description

C 2.1 The Town of Wake Forest is currently serviced by 9 generators with accompanying switchgear and relay protection. The current system has reached its end of life and all generator units will be retired. The proposed project will replace the existing system which will stay in service as necessary until the completion of this project. See site specific location Datasheet (Appendix D) for special demo or removal requirement any of the existing generation infrastructure.

C 2.2 Engineering Scope of Work

D 2.2.1 The Engineering scope of work includes the necessary work to design, specify and install a Generation System. This includes but is not limited to detailed generator prints, switchgear prints, as well as all necessary foundation, civil work, permitting needed. In the appendices of this document there are general specifications and technical specifications for generators, switchgear, and associated protection relays. These specifications are not stand-alone documents but the basis for the construction of said equipment to be designed by the Bidder.

C 2.3 Generators

C 2.3.1 The individual generators shall be standalone units with standard onboard controls by the generator manufacturer. The onboard controls and interface shall be located within the generator enclosure, be visible, and accessible via door with padlocking provisions.

C 2.3.2 Each generator will have a master controller and accompanying switches located within the switchgear. The master controller shall be a Woodward EasYgen 3500XT, or approved equivalent.

C 2.3.3 It is expected that the proposed functionality in the specifications presented can be accomplished without the use of a PLC and that the controls will be achieved with the

use of standard Woodward equipment that is readily available to any customer through Woodward.

C 2.3.4 Each generator will utilize a 24 VDC system appropriately sized.

C 2.3.5 Bidder shall generate any additional drawings required for approval with Owner prior to submitting with Generator Specification as specified in Appendix C. The approved drawing shall accompany the specification provided. The Generator manufacturer's drawings shall be submitted to Owner for review.

C 2.4 Switchgear

C 2.4.1 The exact layout and number of sections for the switchgear is in the scope the Bidder and their selected manufacturer. The Switchgear shall be equipped with an externally mounted 9S meter socket for generation metering output. The meter socket shall be wired to CTs inside the switchgear. The metering CTs shall be strictly dedicated for this function. The Owner will provide the meter. The meter base shall be wired internally per the Owners color codes and specifications.

C 2.4.2 Unless otherwise specified in the Datasheets, switchgear shall include:

D 2.4.2.1 SEL-700G Generator Protection Relay

2.4.2.1.1 Part number 0700G02B1B2X7485A2A0 or approved Equivalent

C 2.4.2.2 Woodward EasYgen 3500XT, or approved equivalent. Programing should provide control of the following but limited to:

2.4.2.2.1 Engine Speed
2.4.2.2.2 Synchronization
2.4.2.2.3 Voltage/PF control
2.4.2.2.4 Frequency/KW control
2.4.2.2.5 Standby mode/L.O.M. Detection and Response

C 2.4.2.3 Emergency Stop Push-Button

C 2.4.2.4 System and mode control switches

C 2.4.2.5 Main breaker and Generator Power disconnects shall be Insulated Case Breakers with appropriate ratings, open/close push-buttons; Schneider NW, or approved equivalent

C 2.4.2.6 SEL RTAC will be the data collector and the client's interface for SCADA This is to be installed by the bidder and provisions made to interconnect controls. DNP Map and RTU programming to be coordinated with the Owner.

C 2.4.2.7 Wireless Modem for SCADA System

C 2.4.3 Unless otherwise specified in the Datasheets in Appendix D, all final connections between the utility distribution system and the switchgear will be the responsibility of the Bidder.

C 2.4.4 Unless otherwise specified in the Datasheets in Appendix D, furnishing of cables and conduit between the utility distribution system and the switchgear will be the responsibility of the Bidder.

C 2.4.5 Bidder shall generate detailed switchgear panel drawings with full parts list for approval with Owner.

C 2.5 Project Deliverables

C 2.5.1 Complete set of electrical, civil, and foundation drawings (if site applicable) for construction. This is to include vendor prints for Switchgear and Generators.

C 2.5.2 Electrical set to include all interconnection drawings including cable and conduit schedules and a full termination of all cables.

C 2.5.3 Civil Set to include all foundations, grade modifications, grounding grid installation, soil, and erosion protection (if site applicable).

C 2.5.4 All prints (including Vendor Prints) must be sealed by a Professional Engineer certified to work in North Carolina. The approval drawings shall be submitted digitally to the Owner and its Engineer. The final record drawings shall be provided digitally as well as two (2) full sets of paper copies. The full installation of completed design including but not limited to switchgear and generators.

C 2.5.5 All relays and controllers shall be programmed by the Bidder. Bidder to produce a settings report included all set point calculations and logic diagrams.

C 2.5.6 A full commissioning on site with training for the Owner's personnel is to be included in Bidder's proposal.

C 2.5.7 Complete turnkey installation of the proposed generators in accordance with the specifications.

C 2.6 Miscellaneous items

C 2.6.1 All relays and controllers shall have standard factory software and programming. **There shall be no proprietary software or functions inside of controllers.**

C 2.6.2 This project includes installations at various locations around the Town of Wake Forest. A prebid meeting will be mandatory.

C 2.7 Engineering Review and Schedule Requirements

C 2.7.1 Bidder shall submit 30%, 60%, and 100% design documents. The milestone schedule will be refined and finalized during the first few initial design meetings/teleconferences.

C 3.0 **General Conditions**

C 3.1 Generator layouts should maintain existing general access and protection structures for fueling and maintenance. If site applicable, *Ground grid shall be designed, installed, and tested to show a ground resistivity of no more than 25 ohms.*

C 3.2 All materials and equipment shall be new. These Specifications describe the type, size and characteristics of the various materials, and equipment required to be furnished. The general arrangement, equipment location and equipment spacing shall be maintained in accordance with the existing design, unless otherwise stated. Adherence to these general Specifications is requested to facilitate checking and consideration of the Proposal.

C 3.2.1 Proposals shall include the following:

C 3.2.2 A complete bill of materials for each site location, identifying each item by catalog number, manufacturer, ratings, characteristics, types, sizes, etc., of all materials and equipment included. A simple statement that all necessary materials and equipment will be provided is not acceptable.

C 3.2.3 The Bidder shall state Exceptions in his Proposal any variations to the specified manner in which the generators will be shipped.

C 3.2.4 Prices shall include the cost of delivery to the job site.

C 3.3 All construction shall be performed in a workmanlike manner and shall conform to the Drawings and Specifications. The installation shall conform to the latest editions of the National Electric Safety Code as applicable.

C 3.4 The Drawings and Specifications are complementary, one to the other. That which is shown on the Drawings or called for in the Specifications shall be as binding as if both were called for and shown. The intention of the Drawings and Specifications is to include all labor, materials, transportation, equipment, and any other items necessary to do a complete job.

C 4.0 **Special Conditions**

C 4.1 Defective Materials, Equipment, and Workmanship

4.1.1 All materials and equipment furnished hereunder shall be subject to the inspection, tests, and approval of the Owner and the Bidder shall furnish all information required concerning the nature or source of any materials and equipment and provide adequate facilities for testing and inspecting the materials and equipment at the plant of the Bidder.

C 4.2 The materials and equipment furnished hereunder shall become the property of the Owner with the completion of the construction, commissioning, and final acceptance of the installation by the owner, provided, however, that the Owner may reject any such materials and equipment as does not comply with the Specifications for materials and equipment and warranties of the Bidder and manufacturers. Recognition and subsequent rejection of any defective materials and equipment may occur either before or after incorporation of such materials and equipment into the facilities; provided such rejection is made within one (1) year from date of delivery of the materials and equipment. Upon any such rejection, the Bidder shall replace the rejected materials and equipment with materials and equipment complying with the Specifications for materials and equipment and warranties, F.O.B. truck at a suitable destination. The Owner shall return the rejected materials F.O.B. truck at the same destination. In the event of the failure of the Bidder to so replace rejected materials and equipment, the Owner may make such replacement and the cost and expense thereof shall be paid by and recoverable from the Bidder.

C 4.3 Miscellaneous

4.3.1 The Bidder shall hold harmless and indemnify the Owner, its agents, and employees, from any and all claims, suits, and proceedings for infringement of any patent or patents covering materials and equipment purchased hereunder. The Bidder shall defend any suit or proceeding brought against the Owner, its agents or employees, based upon a claim that the materials and equipment or any part thereof constitutes an infringement of any patent, or if the Bidder shall fail to defend such suit or proceeding, the Owner may do so and the Bidder shall make reimbursement for the expense of such litigation. If the materials and equipment, or any part thereof is enjoined, the Bidder shall, at its own expense; either procure for the Owner the right to continue to use the materials and equipment, or such part thereof, or shall replace the materials and equipment, or such part thereof, with non-infringing materials and equipment.

C 5.0 **Standards**

C 5.1 All equipment and materials covered by these Specifications and all tests applied thereto shall, unless otherwise stated herein, be in accordance with the applicable provisions of the latest editions of the Standards of the ASTM, ANSI, AEIC, NEMA, NESC, and IEEE as applicable. Where the term "Standards" is used in the Specifications, it shall be understood to refer to the above Standards.

C 6.0 **Drawings**

C 6.1 The Bidder shall provide adequate documentation to fully describe the equipment being furnished. Each set of Approval and Final Drawings and documentation shall include all equipment layout, elevation drawings, schematic drawings, and logic diagrams.

C 7.0 **Shipping**

C 7.1 Equipment shall be shipped upright to the job site in an open-top truck so as to facilitate crane or fork truck unloading. Before shipment, the generators shall be completely assembled, wired and tested to perform the functions required. The method of packing and loading shall be such as to protect all parts from dampness, corrosion, breakage, or vibration damage that might be reasonably encountered in transportation and handling.

C 7.2 Release for shipment is to be granted based upon the manufacturer's compliance with the following:

C 7.2.1 Release for shipment is to be granted based upon the manufacturer's compliance with the following:

C 7.2.1.1 Forty-eight (48) hours notification of factory testing so the Owner may have a representative present to witness the testing.

C 7.2.1.2 Furnishing of the required number of copies of the Final Drawings, test reports, and instruction books as called for in the Specifications.

C 7.2.1.3 Coordination of manufacture and delivery with the Owner's construction schedule as may be noted in the Specifications.

C 7.2.1.4 Thirty (30) days notification of tentative shipping schedule and forty-eight (48) hours notification prior to delivery.

C 8.0 **Commissioning**

C 8.1 A test report shall be provided to the owner verifying all of the relay protection settings and equipment. Commissioning shall not be considered complete until a test report has been submitted and approved by the owner.

C 8.2 The provider shall verify all the system functionality once construction is complete as described in the sequence of events. This shall be completed prior to scheduling the system demonstration and on-site training.

C 8.3 Once the provider has determined the system is complete and working as designed, they shall demonstrate the required functionality with the owner present to verify.

C 8.4 This demonstration shall consist of all the functionality described within the sequence of events along with any additional functions requested by the owner.

C 8.5 The demonstration and on-site training for the owner will be provided within the amount of hours recommended by the Bidder and shall not exceed (5) three consecutive eight (8) hour days.

C 8.6 The on-site training will be open ended format, an expert that can answer any question within reason about the completed generation system shall be available.

APPENDIX C

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

SWITCHGEAR TECHNICAL SPECIFICATIONS

C **1.0 Scope**

These Specifications cover the design, manufacture, and delivery in good order for one (1) out-door Metalclad Switchgear per generator (unless otherwise specified), as specified herein and as required for the operation of the Generation System in the Town of Wake Forest. The work shall include furnishing all Equipment and Materials as set forth in the Bid Documents and as specified herein. The project will include switchgear with generator protection relays, dedicated generator controllers, control switches, power disconnects, and SCADA.

C 1.1 General

C 1.1.1 Equipment will be installed at various site locations in the Town of Wake Forest. Proper precautions shall be taken to minimize environmental effects on the switchgear.

C 1.1.2 The Bidder shall furnish (1) section per generator to accommodate, including but not limited to, the items listed in section 1.0 and 2.4.2, and the required auxiliary power and protection and control wiring, in an outdoor mounting, in accordance with ANSI C37.20.2 and C37.20.7, UL listed in conformance with ANSI C37.54 and C37.55. The switchgear will be equipped as per the Single-Line Diagram and Details outlined on drawings. Bidder to specify the generic equipment arrangement and any deviations from this specification in bid proposal.

C 1.1.3 The switchgear shall be provided as a self-standing outdoor NEMA 3R rated structure. The breaker roof structures shall be weatherproof and sloped to allow rainwater runoff away from switchgear doors, devices, and other openings as appropriate.

C 1.1.4 The structure shall be equipped with guarded LED lighting.

C 1.1.5 The switchgear AC power will be connected to allow the charging of all system emergency batteries and equipment regardless of disconnect switches' states. If applicable, an auxiliary transformer solution shall be furnished by Bidder. Bidder can provide an equivalent or better solution for powering switchgear.

C 1.1.6 Each section shall be provided with a space heater(s) controlled by a thermostat, LED lighting and a convenience receptacle.

E 1.1.7 The enclosure shall be designed for open or closed door racking of the circuit breaker. Closed door racking will be by means of a hand crank. The breaker racking system shall have sufficient interlocks to prevent racking the breaker if the main contacts are closed. The breaker racking system shall have three positions: connected; test position; disconnected.

C 1.1.8 Design tests encompassing the complete equipment design including both the switchgear structure and the circuit breaker removable element, as required by applicable standards, shall have been performed. Production tests in accordance with ANSI Standards and as normally performed by the manufacturer shall be done and certified test reports furnished.

C 1.1.9 Switchgear framework shall be:

C 1.1.9.1 Fabricated on a die-formed steel base or base assembly welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting.

C 1.1.9.2 Designed to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses that occur during operation of the assemblies.

C 1.1.9.3 Rugged steel assemblies with bracing, reinforcing gussets, and jig-welding to assure rectangular rigidity. The sections shall be completely metal-enclosed.

C 1.1.9.4 Each switchgear shall have a bottom as required for ready installation and termination of conduits. Top and bottom conduit entry area and bus duct entries are to be clearly shown and dimensioned on the Shop Drawings.

C 1.1.9.5 The completed building assembly shall be mechanically designed to permit lifting and moving of the entire assembly by crane. This feature shall include properly located lifting lugs and auxiliary lifting bars, if required.

C 1.1.10 All side, top, and rear panels shall be removable, attached by bolts, and small enough for easy handling by one person.

C 1.1.11 Full-length or Half-sized rear doors, hinged, mounted, and equipped with three-point latching and padlockable type operating handles, shall be installed for easy access. Layout will be reviewed when shop drawings are submitted.

C 1.1.12 For switchgear voltage class, phases, wires, frequency, and configuration, see appendix D.

C 1.1.13 The switchgear shall be suitable for outdoor service at an altitude less than 1,100 meters (3600 feet) above sea level.

C 1.2 Dimensions

C 1.2.1 The exact size of the switchgear must conform to the existing foundations and all applicable codes, unless otherwise stated.

C 1.2.2 Conform to the arrangements, details, and space designated for installation.

C 1.2.3 Provide adequate gutter space in all sides of switchgear. Arrange for clearance to permit good accessibility of conductors and bus ducts into switchgear.

C 1.2.4 Bolts, nuts, and washers shall be rustproof metal.

C 1.2.5 All steel parts shall be prepared for painting by a five-(5) step cleaning, phosphatizing, and sealing process. The parts shall then be painted ANSI #70 Sky Gray, on the outside of all enclosures and walkthrough aisle, and white inside each cell, using polyester powder coating applied by the electrostatic method and cured in a baking oven. This finish shall be suitable for outdoor as well as indoor applications.

C 1.2.6 Suitable means shall be provided near the top and bottom of the switchgear to insure adequate ventilation for all equipment within the switchgear assembly.

C 1.3 **DC System**

1.3.1 The switchgear assembly primary power source will be AC. Bidder to size, furnish, and install complete backup DC system with batteries, charger, and devices necessary for uninterrupted power supply to the switchgear in the event of AC failure.

C 1.4 **Bus Bars and Interconnections**

C 1.4.1 All bus and stub connectors shall be tinned copper.

C 1.4.2 Bus bars shall be such that the current density is not greater than the current-carrying capacity of the rectangular copper bars as required by UL and NEMA standards.

C 1.4.3 Bus and stub connections shall be designed to limit temperature rise to 30ºC at load current capacity in a 40ºC ambient environment.

C 1.4.4 Bus bar and interconnection joints shall be *tin or silver plated*, constant-high-pressure type with Grade 5 steel bolts, nuts, and compression washers.

C 1.4.5 Bus bar shall be tin or silver plated to prevent environmental corrosion.

C 1.4.6 The ground bus shall be rated at a minimum of 25 percent current-carrying capacity of the main bus and shall extend across the entire width of the switchgear assembly. The ground bus in each cable entrance shall have pre-drilled ½-inch holes to accept a quantity of four (4), NEMA two-hole copper compression terminals, for connection

of equipment grounding conductors. Location of the holes shall be clearly marked on the Drawings.

C 1.4.7 Main bus bars for the breakers shall be located within the switchgear so as to permit maximum conduit and wiring areas.

C 1.4.8 The continuous ampere rating of main bus shall be sized according to specific site location Datasheet in Appendix D. The bus connections to the power disconnect switches shall match the disconnect switch frame size.

C 1.5 **Compartments**

C 1.5.1 The control sections shall be isolated by steel barriers from the bus sections.

C 1.5.2 Each power disconnect switch shall be installed in an individual front compartment.

C 1.5.3 All bus work shall be installed in their own isolated compartments.

C 1.6 **Instrument and Control Wiring**

C 1.6.1 All devices within the switchgear shall be completely wired, connected, identified, dressed neatly and tied.

D 1.6.2 All conductors for current transformer circuits shall be sized No. 10 AWG. These conductors shall be 600 volts insulation, Type SIS, 105 strands.

C 1.6.3 All conductors for low level signal outputs from transducers shall be sized No. 18 AWG. These conductors shall be 300 volts insulation, twisted, shielded pairs, 16 strands, with copper drain wire, PVC insulation, and PVC jacket.

C 1.6.4 All conductors for relay, control, and metering functions not otherwise specified above shall be sized No. 14 AWG. These conductors shall be 600 volts insulation, Type SIS, 41 strands.

C 1.6.5 All wiring shall be continuous from device terminal to device terminal; no splices shall be permitted. All wiring shall be connected using ring-type terminals; spade-type terminals shall not be used.

C 1.6.6 The cases of all solid state relays, meters, and instruments shall be grounded directly to the cell ground bar with at least No. 12 AWG green stranded tinned copper wire.

C 1.6.7 All wiring to equipment and devices mounted on hinged doors and/or panels shall be extra flexible copper, stranded type.

C 1.6.8 Each internal interconnecting wire shall be identified by a suitable permanent marker at each end with opposite end labeling. Wire numbers shall match the manufacturer's interconnection Drawing.

C 1.6.9 Terminal blocks shall be supplied and clearly marked for wiring that will be installed or reconnected by the Bidder, including wiring between shipping sections.

D 1.6.10 Terminal blocks shall be equipped with Marathon 1500 terminal blocks, 600 volt, white marker strip with black center, sliding link with stainless steel linking screws.

D 1.6.11 Terminal blocks for terminating current transformers shall be shorting-type, Marathon 1500SC.

C 1.6.12 Control circuit fuse blocks shall be rated at 30A, 250V minimum, terminal block-style, multi-pole fused disconnects with spring reinforcement clips.

C 1.6.13 Fuses shall be non-renewable cartridge type with fiberglass tube and shall be sized as required by the respective circuit. Fuses shall be rejection-style. It is not necessary for fuse blocks to be equipped for rejection-style fuses.

C 1.6.14 A ground bar shall be installed in each cell for termination of control wiring grounds. The ground bar shall be a copper bar with drilled and tapped holes for connection of ring tongue terminals. The ground bar shall be physically tied to the main ground bus through a copper connection (bolted copper bar or flexible copper wire).

C 1.6.15 Each section shall have its own set of fuse blocks for disconnection of bus metering voltage, dc power, and ac power.

C 1.7 **Nameplates**

C 1.7.1 Externally visible, permanent nameplates shall be provided to identify each instrument, instrument switch, meter, relay, control switch, indicating light, disconnect compartment. Equipment and terminal blocks within the compartments shall also be suitably identified. Relays shall be designated as to use and as to the phase to which they are connected.

C 1.7.2 Nameplates shall be laminated plastic and attached with screws or high-quality adhesive which would allow for tag removal. Characters shall be white on a black background.

C 1.7.3 Nameplate inscriptions will be reviewed and determined when Shop Drawings are submitted for review.

1.7.4 There shall be one nameplate with contact information including any purchase order, shop order, and serial number needed for warranty or maintenance.

C 1.8 **Auxiliary Cell(s) with PTs**

E 1.8.1 If site applicable, provide draw-out tray(s) for each set protentional transformers with primary and secondary fuses.

C 1.8.2 PT voltages shall be individually fused and ran to all appropriate fusing and terminal blocks.

C 1.8.3 Complete set of wiring, hardware, terminal blocks, and other accessories as needed.

C 1.8.4 There shall be a 9S meter base socket which will be of the cover lock style (no ring lock required) and mounted on the outside of the switchgear connected to the CTs and PTs as shown in the One Line Diagram. The meter base socket shall have test switches for the currents and voltages.

C 1.9 **Switchgear Bus– Protection, Equipment & Controls**

C 1.9.1 A Safety Switch shall be installed at each power disconnect compartment which shall have two positions. The “Enabled” position shall block the power disconnect switch in the respective compartment from being closed.

C 1.9.2 All the protection equipment for the switchgear shall located within the switchgear.

C 1.9.3 ABB FT-1 test switches shall be provided to facilitate testing. All CT’s shall use shorting test switches.

C 1.10 **Spare Parts and Accessories**

C 1.10.1 Accessories

The Bidder shall include in the base bid for each generator:

1.10.1.1 One (1) tube contact lubricant.

1.10.1.2 One (1) container touch-up paint for the switchgear exterior.

1.10.1.3 Four (4) replacement fuse elements for each type of low-voltage fuse used in the switchgear.

C 1.11 **Itemized List of Spare Parts**

The Bidder shall include with the Proposal an itemized list of the spare parts and special tools proposed. Individual item prices shall be stated in this list as well as a total for the complete supply.

C **2.0 Production Tests**

The following tests shall be made to verify that the switchboards and switchgear are manufactured to Specifications. The Owner reserves the right to be in attendance at such testing.

C 2.1 Notification of any and all tests so that the Owner may have a representative present to observe the tests.

C 2.2 Control Wiring Dielectric Test

Tests made to verify that switchboard wiring has an adequate insulation level to ground include the following three alternatives:

C 2.2.1 A test voltage two (2) times rated circuit voltage plus 1000 V (minimum 1500 V), 60 Hz to ground for one minute.

C 2.2.2 A test voltage 20% higher than the one (1) minute value (minimum 1800 V), 60 Hz to ground for one (1) second.

C 2.2.3 An insulation-resistance test using a dc voltage level no less than the ac level listed in (1) above times 1.414 for not more than 1 min with a minimum measured insulation resistance of 1 MΩ.

The procedure is based on the type of circuits and devices on the switchboard. Devices that have been individually tested may be disconnected during the test. Some devices, such as transducers and electronic meters, must be disconnected because the applicable industry standard involves a lower or different permissible dielectric test. Equipment and circuits that operate at 50 V or less, unless otherwise specified, shall be tested in the same manner as above using a test voltage of 500 V, 60 Hz for one (1) minute (Test and Test Procedures, ANSI/NEMA ICS1-1983[6]).

C 2.3 Electrical Operation, Sequence, and Wiring Tests

C 2.3.1 Tests shall be made to verify the correctness (including polarities) of the wiring in the switchgear. Verification shall be made preferably by actual electric operation of the circuit and devices to ensure that the devices function in the proper and intended sequence (functional test) or by individual circuit continuity checks (ring-out).

C 2.3.2 Instruments shall be tested to ensure that pointers move in proper direction. This does not require tests using primary voltage and current.

C 2.4 Full Functional Test

All control circuits including remote wired terminals shall be verified including but not limited to trip, close, block close, lockout relays and all Relay I/O shall be verified.

APPENDIX D

GENERATOR TECHNICAL SPECIFICATIONS

C 1.0 **Scope**

These Specifications cover the design, manufacture, and delivery in good order for Generators, as specified herein and as required for the operation of the Generator System for the Town of Wake Forest.

C 2.0 **Generator Construction**

The generators shall be manufactured by those regularly engaged in the design and manufacture of generators for electric utilities and shall be completely familiar with diesel engines, standby utility generators, and control of utility system generators.

C 2.1 General Requirements

Generators to be supplied shall be diesel fueled (unless otherwise specified). For specific site location generator ratings and functions, see Datasheets in Appendix D.

C 2.2 The generators shall be supplied complete with the following items:

C 2.2.1 Supply of all installation drawings and documentation, Operation and Maintenance manuals.

C 2.2.2 Design, supply, and warranty of:

2.2.2.1 Enclosed generator(s) with a **Tier 4 Final *(Factory Certified)***, reciprocating, inter-cooled engine which is direct coupled to a three phase synchronous generator.

C 2.2.3 Each generator shall be able to provide power on variable load, not to exceed 100% of the power rating.

C 2.2.4 Completely enclosed generator(s) fully suitable for the given environment complete with sufficient space for all engine fluids, noise abatement level 1 enclosure (85db @23 feet), coolant-air radiator, block heater, exhaust systems and all necessary controls including fuel and DEF, remote monitoring (batteries state of charge, fuel/DEF levels, oil level/pressure, engine temp) and ancillary components including but not limited to: batteries, battery charger, task lighting, auxiliary power.

C 2.2.5 Diesel Type II sub-base fuel tank to include the following:

C 2.2.5.1 24 hours run time (unless otherwise specified)

C 2.2.5.2 UL 142 closed top dike construction.

C 2.2.5.3 Normal and emergency vents sized for specific tank.

C 2.2.5.4 Outer containment area vented to atmosphere by design.

C 2.2.5.5 Overspill (spill containment) manhole.

C 2.2.5.6 Overfill analog fuel level gauge with visual and audible alarms.

C 2.2.5.7 Overfill prevention valve

C 2.2.5.8 Leak detection switch (interstitial switch) located within the containment area. *(The leak signal shall be sent to the generator controller for local and remote annunciation).*

E 2.2.5.9 Float switch/gauge with local level audible alarm *(Level alarm signal shall also be sent to the generator controller for local and remote annunciation as indicated below)*:

- Critical Low – 30% *(local and remote)*
- Low – 50% *(local and remote)*
- High – 90% *(local only, audible alarm, momentary 5 second duration)*
- Critically High – 95% *(local only, audible alarm, momentary 15 second duration)*

C 2.2.6 DEF system to include the following:

C 2.2.6.1 24 hours of run time (unless otherwise specified)

C 2.2.6.2 DEF visual level gauge

C 2.2.6.3 Float switch/gauge with local level alarm (Level alarm signal shall be sent to the generator controller for local and remote annunciation as indicated below):

- Critical Low – 30% (local and remote)
- Low – 50% (local and remote)

E • High – 90% (local only, *audible alarm, momentary 5 second duration)*

E • Critically High – 95% (local only, *audible alarm, momentary 15 second duration)*

C 2.2.7 For all load sharing applications, PT are to be used to measure generator potential, they shall have a ratio of 2.3 for 480/277V systems.

C 2.2.8 Generator on board controller shall be manufacturer standard.

C 2.2.9 The generator controls shall be installed in a NEMA 3R enclosure surface mounted on a swing door inside the enclosure.

C 2.2.10 Generator Controls shall be sufficient to operate each individual unit with only local controls consisting of:

2.2.11.1 Indicator lights for gen breakers on local panel
2.2.11.2 Emergency Stop Button
2.2.11.3 Off / Auto / Run switch (3 position)
2.2.11.4 Target Reset Switch

C 2.2.12 Generator will include:

C 2.2.12.2 Factory Acceptance Testing (FAT) complete with all documentation, certificates, test reports

C 2.2.12.3 Remedy all defects.

C 2.2.12.4 Provision of training for Operations and Maintenance staff.

C 2.2.12.5 Provision of Operation and Maintenance manuals

C 2.2.12.6 Provision of spare parts, and special tools.

C 2.2.12.7 Provision of all signed certification for the plant supplied.

C 2.2.12.8 Bumper to bumper warranty during a period of 5 years.

C 3.0 **Installation**

All equipment and materials included in these Specifications are to be installed as proposed by successful bidder and approved by the Owner. All removal of existing equipment shall be by the Bidder.

Owner shall be fairly compensated for any equipment scrap value.

APPENDIX E

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "234 Friendship Chapel"

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To

Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "234 Friendship Chapel"

Quantity: 1

Generator(s) Information

Intended Use	Emergency Back Up Power
Closed Transition Switching	Not Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	~~275~~ 300kW
Phases	3 phase
Rated Voltage (VAC)	208
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Fuel to be remote. Tank supplied by owner
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	_____
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	_____
Voltage (VAC)	_____
Current (A)	_____

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is a make before break connection*

2. *New ASCO transfer switch to be included. Transfer switch to be capable of detecting single phase outages.*
3. *Owner purchased and installed fuel tank.*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "2101 S Main Street"

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To

Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "2101 S Main Street"

Quantity: 2

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	~~135~~ 150kW
Phases	3 phase
Rated Voltage (VAC)	208
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	_____
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	_____
Voltage (VAC)	_____
Current (A)	_____

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

2. *Foundation replacement likely required as existing pad is sloping and cracking*
3. *Will not be able to take outages for installation*
4. *Location has very tight installation constraints.*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "2108 S Main Street"

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To

Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "2108 S Main Street"

Quantity: 1

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	~~135~~ 150kW
Phases	3 phase
Rated Voltage (VAC)	208
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	
Voltage (VAC)	
Current (A)	

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "2104 S Main Street"

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To
Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "2104 S Main Street"

Quantity: 1

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	100
Phases	3 phase
Rated Voltage (VAC)	208
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	_____
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	_____
Voltage (VAC)	_____
Current (A)	_____

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "2114 S Main Street"

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To

Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "2114 S Main Street"

Quantity: 1

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	~~1400~~ 1250kW
Phases	3 phase
Rated Voltage (VAC)	480
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	_____
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	_____
Voltage (VAC)	_____
Current (A)	_____

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

2. *Foundation work likely required*
3. *Unit is a PURPA qualifying facility*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "11016 Capital Blvd "

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To

Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "11016 Capital Blvd"

Quantity: 1

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	300
Phases	3 phase
Rated Voltage (VAC)	~~277/480~~ 208/120V
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	
Voltage (VAC)	
Current (A)	

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "301 Brooks Street "

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To
Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "301 Brooks Street"

Quantity: 1

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	~~450~~ 600kW
Phases	3 phase
Rated Voltage (VAC)	277/480
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	_____
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	_____
Voltage (VAC)	_____
Current (A)	_____

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

Notes

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

DATA SHEET FOR "12430 Capital Blvd "

Scope

The Bidder's work shall include furnishing the Generator(s) and Switchgear so represented by this Data Sheet and accompanying Bid Documents. Special cases and requirements for this site are listed in the "Special Cases" section below.

Submit Drawings and/or Accompanying Documents To
Brandon Douglas, PE: Booth & Associates, LLC (brandon.douglas@booth-assoc.com)

Drawing Stamp: WAKE FOREST POWER – "12430 Capital Blvd"

Quantity: 1

Generator(s) Information

Intended Use	Peak Shaving
Closed Transition Switching	Required
Enclosure Rating	NEMA 3R
Rated Power Output (kW)	150
Phases	3 phase
Rated Voltage (VAC)	277/480
Rated Rotation (rpm)	1800rpm
Integrated Fuel Tank	Yes
Fuel Type	Diesel
Runtime (hrs)	24

Switchgear Information (Bidder to specify)

Manufacturer	_____
Type	Metal enclosed
Enclosure Rating	NEMA 3R
Power Configuration	_____
Voltage (VAC)	_____
Current (A)	_____

Special Cases

Any applicable clarifications or special requirements will be listed here:

1. *This site is used for peak shaving*

APPENDIX F

WAKE FOREST POWER
WAKE FOREST, NORTH CAROLINA

SPECIFICATIONS AND BID DOCUMENTS
FOR A GENERATION SYSTEM
FOR THE TOWN OF WAKE FOREST

SEQUENCE OF OPERATION

1. The generation system will have the following Modes of operation:
   - 1.1 **Standby Mode** – Allows the Generation System to energize the load during Utility loss of power with an automatic synchronized return to the grid once service is restored.
   - 1.2 **Load Management Mode** - Allows synchronized and long-term parallel operation of the Generation System with Utility power for peak shaving.

2. Normal Conditions

- 2.1 Under normal conditions, the loads will receive power from Utility through the new Switchgear. Under no circumstances shall the Utility. The generation system will be inactive during normal conditions.
- 2.2 Generator circuit breaker will be open.

3. Standby Mode

- 3.1 If power from Utility is lost, the generation system shall automatically enter Standby Mode through the following sequence steps:
  - 3.1.1 The generation system controller (Woodward 3500XT) will send a signal to activate the generators within 20 seconds of loss of Utility power.
  - 3.1.2 Main Circuit breaker will be automatically opened
  - 3.1.3 Once generator reaches rated voltage and frequency, the generator circuit breaker shall close.
- 3.2 Once Utility power returns, the generation system shall monitor utility stability (voltage & frequency). If the utility is considered stable for one minutes the system will return to normal Mode. The sequence for "Return to Normal" shall be as follows:
  - 3.2.1 Synchronize the generation system with utility
  - 3.2.2 Main circuit breaker will close
  - 3.2.3 Ramp down the loading from the generators
  - 3.2.4 Open generator circuit breaker.
  - 3.2.5 The generators shall run through the cool-down cycle recommended by the provider

4. Load Management Mode

- 4.1 This Mode shall be initiated by a remote or local signal. Once activated the following shall occur automatically:
  - 4.1.1 An activation signal shall be sent to the generators
  - 4.1.2 The generators will reach rated voltage and frequency and will synchronize with the utility source across.
  - 4.1.3 The generators shall be capable of support load up to their LTP power rating or to a level allowing a minimal import from the grid. ~~Exporting excess of power into the utility distribution system will not be allowed.~~

System will be equipped with local and remote ability for the system to run in either process or base load (Export) modes

4.2 The generation system will remain in this Mode until a signal is received signifying the end of Load Management Mode.

4.3 Once a signal to terminate is received, the following shall occur automatically:

- 4.3.1 Ramp down generator loading
- 4.3.2 Open Generator circuit breaker.
- 4.3.3 The generators shall run through the cool-down cycle recommended by the provider

Equipment Generic Specifications

PowerSecure

UL 891
LV Switchboards



- **UL 891 Low Voltage (LV) Deadfront Switchboards provide protection, metering, switching, control and automation of LV electrical systems in commercial and industrial applications**
- **Provides connectivity to primary distribution lines, feeders, motors, transformers, generators, filters, capacitor banks through cables and bus duct**
- **Application scope includes transfer schemes, generator control, generator/utility paralleling, motor control and load management**
- **Breaker compartmentalization available as individual, grouped or integrated**
- **Stock Square D I-Line chassis for distribution sections. Other manufacturers available upon request.**
- **Available breaker types include molded case circuit breaker (MCCB), insulated case circuit breaker (ICCB) and low voltage circuit breakers (LVCB)**
- **Front, rear or side access available**
- **3 cycle bus standard (30 cycle bus available)**
- **225A to 6000A ratings**
- **Indoor Type 1 and Outdoor Type 3R enclosures**
- **Stainless steel and Galvaneal enclosures available**
- **Custom paint colors available**
- **Manufactured per UL requirements and applicable NEMA and ANSI standards**
- **Provide replacement/upgrade of existing equipment and fitting new gear to existing equipment**
- ***Vendor neutral; freedom to use best equipment for the application or to meet customer preferences***
- ***Design/Build and Custom Switchgear Specialists***
- ***Protection, metering, control, automation and integration expertise***

PowerSecure UL-891 Low Voltage Switchboards have the following features:

- Typical application includes MCCBs and ICCBs, with or without trip units
- Depending on selective coordination requirements, LVCBs may be applied on mains, ties and other breaker positions
- Enclosure doors may be used to mount instruments, meters, protective relays, indicators and other secondary control devices and their associated wiring.
- Optional grounded metal or glasstic barriers are available to enclose the primary circuit components (breakers, switches, fuses, bus, instrument transformers, and control power transformers) from the cable connections.

Applicable Standards

UL (Underwriters Laboratory)

- 50, Enclosures for Electrical Equipment, Non-Environmental Considerations
- 67, Panelboards
- 508, Industrial Control Equipment
- 891, Dead-Front Switchboards
- 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures
- 1066, Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

ANSI: American National Standards Standard Institute

- C37.13, Low-Voltage AC Power Circuit Breakers Used in Enclosures
- C37.16, Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers
- C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers
- C37.50, Test Procedures for Low Voltage AC Power Circuit Breakers Used in Enclosures
- C37.100, Definitions for Power Switchgear
- NFPA 70, National Electrical Code

NEMA: National Electrical Manufacturers Association

- AB-1, Molded case Circuit Breakers and Molded Case Switches
- PB-2, Deadfront Distribution Switchboards
- ST-20, Dry-Type Transformers for General Applications

GILLETTE GENERATORS

LIQUID COOLED DIESEL ENGINE GENERATOR SET

60 HZ MODEL

T4D-1000

Model	HZ	STANDBY 130ºC RISE	PRIME 105ºC RISE
T4D-1000-60 HERTZ	60	100	100

All generator sets are USA prototype built and thoroughly tested. Production models are USA factory built and 100% load tested.

UL1446, UL508, UL142, UL498

NFPA 110, 99, 70, 37
All generator sets meet NFPA-110 Level 1, when equipped with the necessary accessories and installed per NFPA standards.

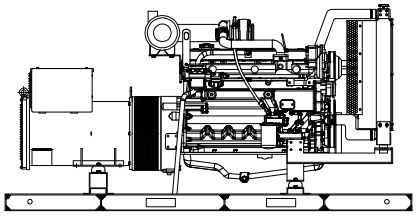
NEC 700, 701, 702, 708

NEMA ICS10, MG1, ICS6, AB1

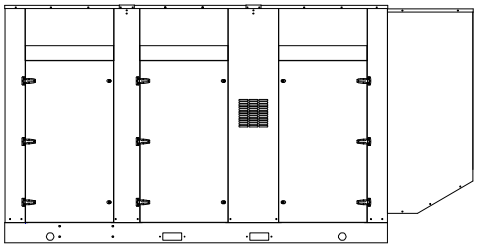
ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05

ASCE 7-05 & 7-10
All generator sets meet 180 MPH rating.

EPA 40CFR Part 60, 89, 1039, 1048, 1054, 1065, 1068



"OPEN" GEN-SET
There is no enclosure, so gen-set must be placed within a weather protected area, un-inhabited by humans or animals, with proper ventilation. Silencer not supplied, as installation requirements are not known. However, this item is available as optional equipment.



"LEVEL 2" HOUSED GEN-SET
Full aluminum weather protection and superior sound attenuation for specific low noise applications. Critical grade muffler is standard.

GENERATOR RATINGS

GENERATOR MODEL	VOLTAGE		PH	HZ	130°C RISE STANDBY RATING		105°C RISE PRIME RATING	
	L-N	L-L			KW/KVA	AMP	KW/KVA	AMP
T4D-1000-1-1	120	240	1	60	100/100	417	100/100	417
T4D-1000-3-2	120	208	3	60	100/125	347	100/125	347
T4D-1000-3-3	120	240	3	60	100/125	301	100/125	301
T4D-1000-3-4	277	480	3	60	100/125	151	100/125	151
T4D-1000-3-16	346	600	3	60	100/125	120	100/125	120

RATINGS: All three phase gen-sets are 12 lead windings, rated at .8 power factor. 130° C "STANDBY RATINGS" are strictly for gen-sets that are used for back-up emergency power to a failed normal utility power source. This standby rating allows varying loads, with no overload capability, for the entire duration of utility power outage. 105° C "PRIME RATINGS" are strictly for gen-sets that provide the prime source of electric power, where normal utility power is unavailable or unreliable. A 10% overload is allowed for a total of 1 hour, within every 12 hours of operation, on every PRIME RATED systems. All gen-set power ratings are based on temperature rise measured by resistance method as defined by MIL-STD 705C and IEEE STD 115, METHOD 6.4.4. All generators have class H (180°C) insulation system on both rotor and stator windings. All factory tests and KW/KVA charts shown above are based 130°C (standby), and 105°C (prime) R/R winding temperature, within a maximum 40°C ambient condition. Generators operated at standby power ratings must not exceed the temperature rise limitation for class H insulation system, as specified in NEMA MG1-22.40. Specifications & ratings are subject to change without prior notice.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-1000-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer ..... Stamford Generators
Model & Type ..... UCI274E-311, 4 Pole, 12 Lead, Three Phase
..... HCI434D-17, 4 Pole, 12 Lead, 600V, Three Phase
Exciter ..... Brushless, shunt excited
Voltage Regulator ..... Solid State, HZ/Volts
Voltage Regulation ..... ½%, No load to full load
Frequency ..... 60 HZ
Frequency Regulation ..... ± ½% (1/2 cycle, no load to full load)
Unbalanced Load Capability ..... 100% of standby amps
One Step Load Acceptance ..... 100% of nameplate rating
Total Stator and Load Insulation ..... Class H, 180°C
Temperature Rise ..... 105°C R/R, prime rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V) ... 1500 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V-600V) 2300 kVA
Bearing ..... 1, Pre-lubed and sealed
Coupling ..... Direct flexible disc.
Total Harmonic Distortion ..... Max 3½% (MIL-STD705B)
Telephone Interference Factor ..... Max 50 (NEMA MG1-22)
Deviation Factor ..... Max 5% (MIL-STD 405B)
Alternator ..... Self ventilating and drip-proof
Ltd. Warranty Period ..... 24 Months from start-up date or
..... 1000 hours use, first to occur.

GENERATOR FEATURES

- World Renown Stamford Electric Generator having UL-1446 certification.
- Full generator protection with **Basler DGC-2020** controller, having UL-508 certification.
- Automatic voltage regulator with over-excitation, under-frequency compensation, under-speed protection, and EMI filtering. Entire solid-state board is encapsulated for moisture protection.
- Generator power ratings are based on temperature rise, measured by resistance method, as defined in MIL-STD 705C and IEEE STD 115, Method 6.4.4.
- Power ratings will not exceed temperature rise limitation for class H insulation as per NEMA MG1-22.40.
- Insulation resistance to ground, exceeds 1.5 meg-ohm.
- Stator receives 2000 V. hi-potential test on main windings, and rotor windings receive a 1500 V. hi-potential test, as per MIL-STD 705B.
- Full amortisseur windings with UL-1446 certification.
- Complete engine-generator torsional acceptance, confirmed during initial prototype testing.
- Full load testing on all engine-generator sets, before shipping.

ENGINE SPECIFICATIONS AND APPLICATIONS DATA

ENGINE

Manufacturer ..... VOLVO-PENTA
Model and Type ..... TAD571VE, 4 cycle, liquid Cooled
Aspiration ..... Turbo After Cooler, Air to Air
Charged Air Cooled System ..... Air to Air
Cylinder Arrangement ..... 4 Cylinders, In-Line
Displacement Cu. In. (Liters) 291 (4.76)
Bore & Stroke in (Cm) ..... 4.33 x 5.31 (11.0 x 13.5)
Compression Ratio 17.5:1
Main Bearings ..... Tin Overlay with Babbit Backing
Cylinder Head ..... Cast Iron with overhead Cam
Pistons ..... Aluminum Alloy with Graphite Coating
Crankshaft ..... Induction Hardened, Heat Treated Forged
Valves ..... Heat Treated and Hardened Exhaust Valve
Governor ..... Electronic, EMS 2.2
Frequency Regulation ..... ± 1/4%
Air Cleaner ..... Dry, Replaceable Cartridge
Engine Speed ..... 1800 rpm
Max Power, bhp (kwm) Standby 175 (131)
BMEP: psi (MPa) Standby 331 (2.3)
Ltd. Warranty Period ..... 1 Year or 1000 hrs, first to occur

FUEL SYSTEM

Type ..... Diesel Fuel Oil (ASTM No. 2-D)
Combustion System ..... Direct Injection
Fuel Injection Pump ..... Electronic, Delphi E3
24 VDC Coolant heaters ..... Optional Equipment
Fuel Filter .... Yes with Water Separator

FUEL CONSUMPTION

GAL/HR (LITER/HR)	STANDBY	PRIME
100% LOAD	7.5 (28.4)	7.5 (28.4)
75% LOAD	6.4 (24.1)	6.4 (24.1)
50% LOAD	4.6 (17.3)	4.6 (17.3)
DEF Consumption is 6% of fuel consumption		

OIL SYSTEM

Type ..... Full Pressure
Oil Pan Cap. W/ filter qt. (L) 16.9 (16)
Oil Filter ..... 3, Replaceable Cartridge type

ELECTRICAL SYSTEM

Ignition System ..... Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 110 amp/hr.

Recommended battery to -18°C (0° F): ....(2) 12 VDC, BCI# 31, Max. Dimensions: 14"lg x 6 3/4" wi x 10" hi, with standard round posts. Min output 1000 CCA. Battery tray (max. dim. at 15"lg x 7"wi). This model has (2) battery trays, (2) hold down straps, (2) sets of battery cables, and (1) battery charger. Installation of (2) 12VDC starting batteries connected in series for 24VDC output is required, with possible higher AMP/HR rating, as described above, if the normal environment temperature averages -13° F (-25°C) or cooler.

CERTIFICATIONS

All engines are EPA emissions certified. All non-emergency stationary diesel engines are Tier IV Final compliant.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-1000-60 HZ

COOLING SYSTEM

Type of System ..... Air to Air, Charged Air Cooler
Coolant Pump .....Pre-lubricated, self-sealing
Cooling Fan Type .....Pusher
Fan Diameter inches (cm).....35.1 (89)
Fan drive ratio..... 1.04:1
Ambient Capacity of Radiator °F (°C).....131 (55)
Engine Jacket Coolant Capacity gal. (L).....3.4 (13)
Radiator Coolant Capacity gal. (L) 10.2 (38.6)
Water Pump Capacity gpm (L/min)..... .....122 (462)
Heat Reject Coolant: Btu/min ....….12,682
Air to Air Heat Reject, BTU/min. ....….11,715
Heat Radiated to Ambient, BTU/min .... ….4,253
Low Radiator Coolant Level Shutdown……..Standard
Note: Coolant temp. shut-down switch setting at 228°F (109°C) with 50/50 (water/antifreeze) mix.

COOLING AIR REQUIREMENTS

Combustion Air cfm (m^3/min) 332 (9.40)
Max Air Intake Restrictions:
Clean Air Cleaner, KPA (psi) 5 (1.5)
Radiator Cooling Air, SCFM (m^3/min)…….....10,954 (310)

EXHAUST SYSTEM

Exhaust Outlet Size.....4"
Max. Back Pressure in KPA (in. H2O).....6 (24)
Exhaust Flow, at rated KW, CFM (m3/min)..... 689 (19.5)
Exhaust Temp, (Stack) °F (ºC) 716 (380)

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, SCR/Residential Silencer	82	78

Note: Open sets (no enclosure) have installed selective catalytic reduction/residential silencer system. Level 2 enclosure has installed selective catalytic reduction/residential silencer. Sound tests are averaged from several test points and taken at 23 ft. (7 m) from source of noise at normal operation.

DERATE GENERATOR FOR ALTITUDE

3% per 1000 ft. (305m) above 3000 ft. (914m) from sea level

DERATE GENERATOR FOR TEMPERATURE

2% per 10°F (5.6°C) above 104°F (40°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm)	132 (335)	162 (412)
Width in (cm)	52 (132)	52 (132)
Height in (cm)	65 (165)	80 (203)
Net Weight lbs (kg)	3977 (1804)	5247 (2380)
Ship Weight lbs (kg)	4252 (1929)	5592 (2537)

BASLER DGC-2020 DIGITAL MICROPROCESSOR CONTROLLER



Basler DGC-2020

The "**2020**" controller is a highly advanced integrated gen-set control system for single gen-set applications. This controller includes a backlit LCD display which continuously displays the status of the engine and generator at all times.

Basler "**DGC-2020"** includes: Generator metering (including three phase) • Engine – Generator protections including IEEE-[27] under voltage, [32] power, [40] loss of excitation, [59] over voltage, [81] over and under frequency, Exercise timer • SAE J1939 engine ECU communications • Expansion capabilities for both inputs and outputs with expansion • Remote communications through RS-485 to Basler's RDP110 remote Display panel • (16) programmable contact inputs • (15) programmable contact outputs- (3) for up to 30AmpDC and (12) for up to 2 Amp DC • Illuminated Text Display • Front panel menu scroll buttons • Front panel operation mode buttons for STOP, RUN and AUTO • Alarm Silence and Lamp Test buttons

This controller includes expansion features including, RS485 (using MODBUS), direct USB connection with PC, expansion optioned using BESTCOMSPlus for remote annunciation and remote relay interfacing for a distance of up to 3300FT. The controller software is freely downloadable from the internet and allows monitoring with direct USB cable, LAN, or by internet via the built in web interface.



Further expansion is available by adding the optional RDP-110 remote display panel module. This featured device will allow Four programmable LEDs (2) alarms and (2) pre-alarms • (17) alarms and pre-alarms displayed from Basler controller • audible alarm horn • lamp test and alarm silence buttons • RD100 local power supply inputs of either 12vdc or 24vdc • connects through Basler controller through RS-485 communications protocol • conduit box included for (2) mounting configurations- either surface mount or semi-flush mounting.

STANDARD FEATURES FOR MODEL T4D-1000-60 HZ

STANDARD FEATURES

CONTROL PANEL:

Basler DGC-2020 digital microprocessor with logic allows programming in the field. Controller has:

- STOP-MANUAL-AUTO modes and automatic engine shutdowns, signaled by full text LCD indicators:
- Low oil pressure
- High engine temp
- Low Radiator Level
- Three auxiliary alarms
- Battery fail alarm
- Engine fail to start
- Engine over speed
- Engine under speed
- Over & under voltage

Also included is tamper-proof engine hour meter

ENGINE:

Fuel filter • Full flow Oil filter • Air filter • Fuel pump • Oil pump • Solenoid type starter motor • Hi-temp radiator • Jacket water pump • Thermostat • Pusher fan and guard • Exhaust manifold • Electronic Governor • 24 VDC battery charging alternator • Flexible fuel and exhaust connectors • Vibration isolators • Open coolant recovery system with 50/50 water to anti-freeze mixture • flexible oil & radiator hose • Shut-down sensors for low oil pressure, high coolant temp., low coolant level, high ambient temp.

Design & specifications subject to change without prior notice. Dimensions shown are approximate. Contact Gillette for certified drawings. DO NOT USE DIMENSIONS FOR INSTALLATION PURPOSES.

AC GENERATOR SYSTEM:

AC generator • Shunt excited • Brushless design • Circuit Breaker installed and wired to gen-set • Direct connection to engine with flex disc • Class H, 180°C insulation • Self ventilated • Drip proof construction • UL Certified

VOLTAGE REGULATOR:

1% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

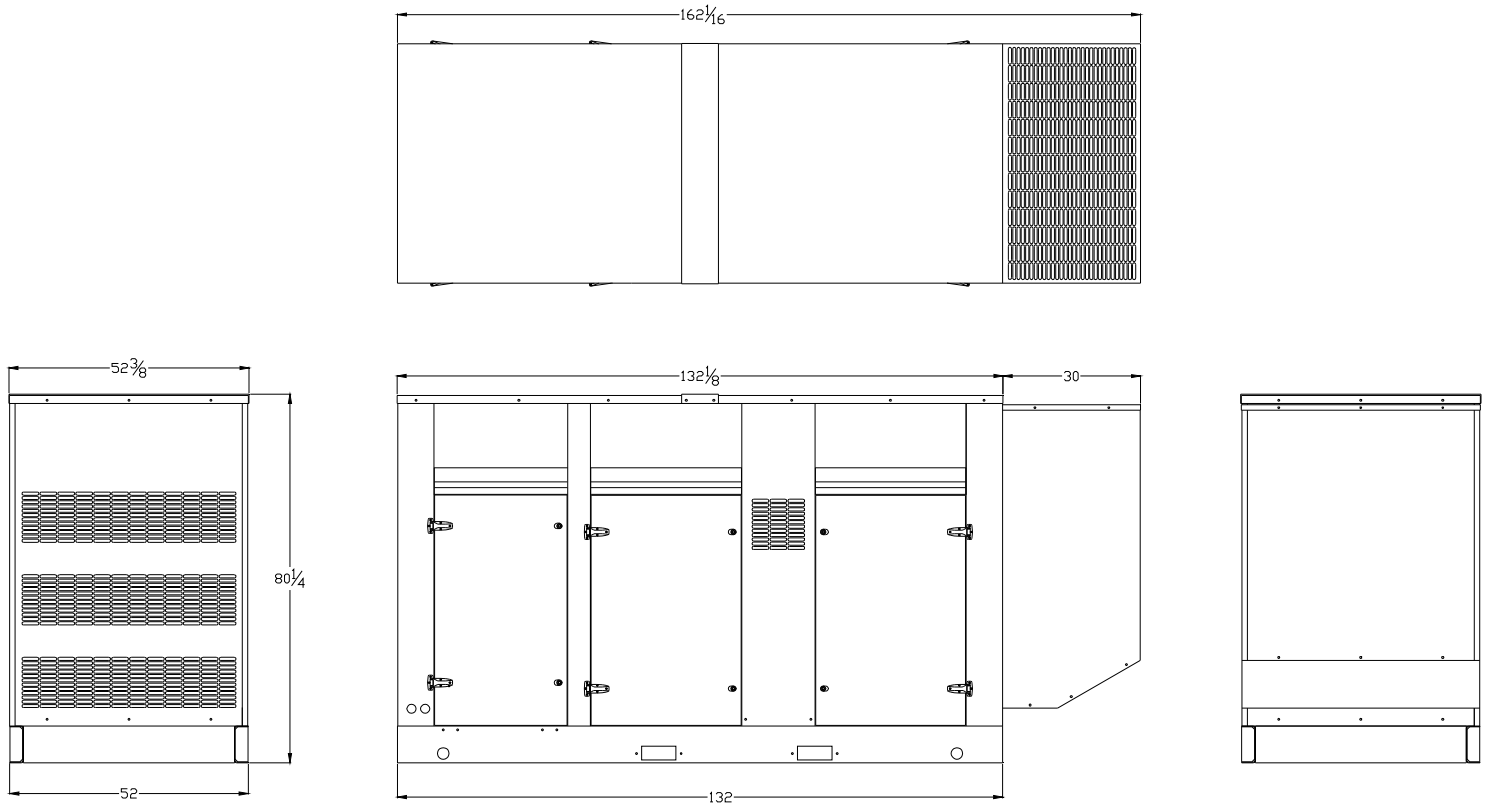
DC ELECTRICAL SYSTEM:

Battery trays • Battery cables • Battery hold down straps • 3-stage battery charger with float, absorption, & bulk automatic charge stages

WEATHER / SOUNDPROOF ALUMINUM HOUSING:

Corrosion Resistant Protection consisting of:

- (9) Heated and Agitated Wash Stages
- Zinc Phosphate Etching-Coating Stage
- Final Baked on Enamel Powder Coat
- 18/8 Stainless Steel Hardware



Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with ⚠ are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalities as described in the Clean Air Act.

General

In-line four stroke diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel

Number of cylinders			4
Displacement, total		liters in^3	5,13 313
Firing order			1-3-4-2
Bore		mm in	110 4,33
Stroke		mm in	135 5,31
Compression ratio			17.5:1
Wet weight (Not including after treatment system)	Engine only	kg lb	583 1285
	Power pac	kg lb	877 1933
	Power pac, compact cooling package	kg lb	802 1768

Performance				**rpm**	**1500**	**1800**	**2000**	**2300**
ICFN Power 129 kW		without fan		kW hp	126 171	129 175	129 175	129 175
		with fan 600 mm pull		kW hp	123 167	124 168	123 167	124 169
Torque at:		ICFN Power 129 kW		Nm lbf ft	800 590	685 505	616 454	536 395
Max torque at engine speed	ICFN Power		1200 rpm	Nm lbf ft	810 597			
Power tolerance				%	±3			
Mean piston speed				m/s ft/sec	6,8 22,1	8,1 26,6	9,0 29,5	10,4 34,0
Effective mean pressure at:		ICFN Power 129 kW		MPa psi	1,96 285	1,68 243	1,51 219	1,31 190
Total mass moment of inertia, J (mR^2) (not including flywheel)				kgm^2 $lbft^2$	0,253 6,0			
Friction Power				kW hp	12 16	16 22	20 27	26 35
Derating see Technical Diagrams								

Cold start performance

*Cold start limit temperature	without starting aid	°C °F	-15 5	
	with manifold heater 4 kW	°C °F	-30 -22	
	with manifold heater 4 kW and block heater	°C °F	-35 -31	
*Specify oil quality	Above -15°C; 15W40 Above -25°C; 10W30 Below -25°C; 5W30			
Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
	Volvo	1,5		

* See also general section in the sales guide

Lubrication system

Lubricating oil consumption (average)			Vol%	0,05
Oil system capacity including filters			liter US gal	16 4,23
Oil pan capacity:		Max	liter US gal	13,5 3,57
		Min	liter US gal	9,5 2,51
Oil change intervals/specifications	VDS4		h	500
			h	
Engine angularity limits:		front up	°	40
		front down	°	45
		side tilt	°	40
Oil pressure at rated power			kPa psi	425 62

Lubrication system

Lubrication oil temperature in sump:	max	°C °F	125 257
Oil filtration efficiency (in accordance with ISO 4548-12)	97%	µ	36
	50%	µ	14

Fuel system

Urea consumption (vol% of diesel consumption)		vol%	7%
Fuel to conform to			EU EN590 US D975, 1-D and 2-D (Max 15ppm sulphur and 7% FAME)
System supply flow at max. speed		liter/h US gal/h	102 26,9
Fuel supply line max. restriction (Measured at fuel inlet connection)		kPa psi	25 3,6
Fuel supply line max. pressure, during engine stand still (meassured at fuel inlet connection)		kPa psi	20 2,9
System return flow at max. speed		liter/h US gal/h	60,0 15,9
Fuel return line max. restriction (Measured at fuel return connection)		kPa psi	15 2,2
Max. allowable inlet fuel temp (Measured at fuel inlet connection)		°C °F	80 176
Prefilter / Water separator filtration efficiency	99%	µ	30
Main fuel filter filtration efficiency (in accordance with ISO 19438)	98%	µ	5
	96%	µ	4
Governor type/make, standard		Volvo/ EMS 2.3	
Injection pump type/make		Denso HP3	

Intake and exhaust system		**Inlet air temp**	**rpm**	**1500**	**1800**	**2000**	**2300**
Charge air consumption at: (+25°C and 100kPa)	ICFN Power 129 kW	25°C	m³/min	8,5	9,4	10,2	11,7
		77°F	cfm	300	332	360	413
⚠ **See front page for important information** Max allowable air intake restriction including piping			kPa psi	6 0,9			
Heat rejection to exhaust at:	ICFN Power 129 kW		kW BTU/min	73 4146	74 4214	75,6 4299	86,9 4942
Exhaust gas temperature after turbine at:	ICFN Power 129 kW		°C °F	411 772	380 716	362 684	364 687
⚠ **See front page for important information** Max allowable back pressure in exhaust line (after turbine) Pipe dimension Ø: 102 mm			kPa psi	11 1,6	11 1,6	12 1,7	13 1,9
⚠ **See front page for important information** Max allowable temperature drop between turbine and SCR muffler inlet (in average over a typical customer cycle (not stationary points)).			Δ°C Δ°F	15 27			
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)			kPa psi	5 0,7	5 0,7	6 0,9	6 0,9
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	ICFN Power 129 kW		m³/min cfm	18,6 657	19,5 689	20,3 717	23 812

Cooling system			rpm	1500	1800	2000	2300
Heat rejection radiation from engine at:		ICFN Power 129 kW	kW	7	6	4,8	5
			BTU/min	387	318	273	284
Heat rejection to coolant at:		ICFN Power 129 kW	kW	70	77	80,9	84,2
			BTU/min	3981	4356	4601	4788
Radiator cooling system type				Closed circuit			
Standard radiator core area		ICFN Power 129 kW	m²	0,6			
			foot²	6,46			
Compact cooling package radiator core area		ICFN Power 129 kW	m²	0,28			
			foot²	3,01			
Fan diameter	600 mm	ICFN Power 129 kW	mm	600			
			in	23,62			
Fan power consumption	600 mm pull		kW	3,0	5,2	6,3	4,7
			hp	4	7	9	6
Fan drive ratio	fan Ø600			1.4:1			
Coolant capacity:	engine		liter	13			
			US gal	3,4			
	engine + standard radiator with hoses and expansion tank		liter	47			
			US gal	12,4			
	engine + compact cooling package radiator with hoses and expansion tank		liter	31			
			US gal	8,2			
Coolant pump			drive/ratio	belt/1,40:1			
Coolant flow with standard system			l/s	5,4	6,5	7,2	8,2
			US gal/s	1,4	1,7	1,9	2,2
Minimum coolant flow			l/s				4,5
			US gal/s				1,2
Maximum outer circuit restriction incl. piping			kPa	40,0			
			psi	5,8			
Thermostat:		start to open	°C	85			
			°F	185			
		fully open	°C	95			
			°F	203			
Maximum static pressure head (expansion tank height + pressure cap setting)			kPa	110			
			psi	16,0			
Minimum static pressure head (expansion tank height + pressure cap setting)			kPa	85			
			psi	12,3			
Standard pressure cap setting			kPa	100			
			psi	14,5			
Maximum top tank temperature			°C	107			
			°F	225			
Recommended Draw down capacity. The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still are functioning			liter	2			
			US gal	0,5			

Charge air cooler system		rpm	1500	1800	2000	2300
Heat rejection to charge air cooler	ICFN Power 129 kW	kW	21,2	23,7	24,7	28,6
		BTU/min	1206	1348	1405	1626
Charge air mass flow	ICFN Power 129 kW	kg/s	0,165	0,184	0,198	0,228
Charge air inlet temp. (Charge air temp after turbo compressor)	ICFN Power 129 kW	°C	177	177	174	177
		°F	351	351	345	351
⚠ **See front page for important information** Max allowable Charge air outlet temp. (Charge air temp after charge air cooler)		°C	49	49	50	50
		°F	120	120	122	122
⚠ **See front page for important information** Maximum pressure drop over charge air cooler incl. piping		kPa	8	9	10	12
		psi	1,16	1,31	1,45	1,74
Charge air pressure (relative) (After charge air cooler)		kPa	197	199	191	172
		psi	28,57	28,86	27,70	24,95
Standard charge air cooler core area		m²	0,5			
		foot²	5,38			
Compact charge air cooler core area		m²	0,22			
		foot²	2,37			

Cooling performance: 0,6 m² radiator and 600mm fan, pull

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and std coolant. Valid at 1 atm.

		ICFN Power 129 kW					
Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	m^3/s	ft^3/s	Pa	psi
1500	121	77	171	6,2	219,0	0	
	165	77	170	5,9	208,4	100	0,015
		76	169	5,8	204,8	200	0,029
		74	165	5,2	183,6	300	0,044
2300	129	76	169	7,6	268,4	0	
	175	76	168	7,4	261,3	100	0,015
		75	167	7,2	254,3	200	0,029
		75	166	7,1	250,7	300	0,044

Cooling performance: 0,28 m² radiator and 600mm fan, pull

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

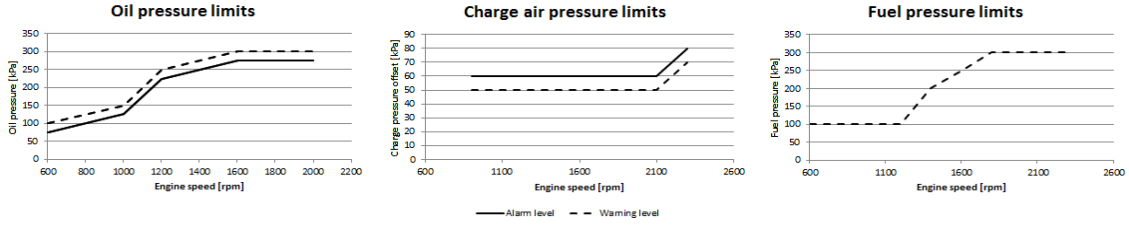
		ICFN Power 129 kW					
Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	m^3/s	ft^3/s	Pa	psi
1500	121	56	133	5,9	208,4	0	
	165	55	130	5,7	201,3	100	0,015
		52	126	5,4	190,7	200	0,029
		47	116	4,8	169,5	300	0,044
2300	129	55	131	7,0	247,2	0	
	175	54	130	6,9	243,7	100	0,015
		53	127	6,6	233,1	200	0,029
		51	123	6,2	219,0	300	0,044

Engine management system

Functionality	Alternatives			Default setting
Governor mode	Droop	Isochronous		Isochronous
Governor droop	10	125	Nm/rpm	
Governor response	Adjustable PI constants			
Idle speed	600	900	rpm	700
Stop function				Replaced by "Ignition of stop engine"
Preheating function	Ignition	Request	Request + temp	If preheat is available, preheat will be active at ignition on if temp low or demanded by driver.
Lamp test				No lamp test, not used any longer
Ignition of stop engine	Yes	No		No

Engine sensors and switch settings			Alarm level		Engine protection	
Parameter		**Unit**	**Setting range**	**Default setting**	**Level**	**Action. Default/Alternative**
Oil temp		°C		125	125	Derate/Shut down
Oil pressure	Low idle	kPa		75,0	75	Shut down.
	Rated speed	kPa		275	275	Shut down.
Oil level				Low level		
Coolant temp		°C		107	107	Derate/Shut down
Coolant level			See cooling system	On	Low level	Derate/Shut down
Fuel feed pressure	Low idle	kPa		100		
	Rated speed			300		
Water in fuel				Alarm when closed		
EGR temp		°C		210	210	Derate/Shut down
Air filter pressure drop				5kPa		
Altitude, above sea		m			700	Automatic derating, see section derating
Charge air temp		°C		120	120	Derate/Shut down
Charge air pressure		kPa		Alarm map value	Alarm map value	Derate/Shut down
SCR temp		°C		515	515	Derate

Parameter	Warning	Alarm	Derated 0% to engine protection map	Derated 100% to engine protection map	Forced idle after 5 sec	Forced shut down after 0 sec
Coolant temp	102°C	107°C	107°C	112°C		
Oil temp	120°C	125°C	125°C	130°C		
Low oil pressure	Warning map value	Alarm map value				Alarm map value
High charge air temp	115°C	120°C	120°C	140°C		
High charge air pressure	Warning map value	Alarm map value		Alarm map value		
EGR temp	200°C	210°C	210°C	220°C		



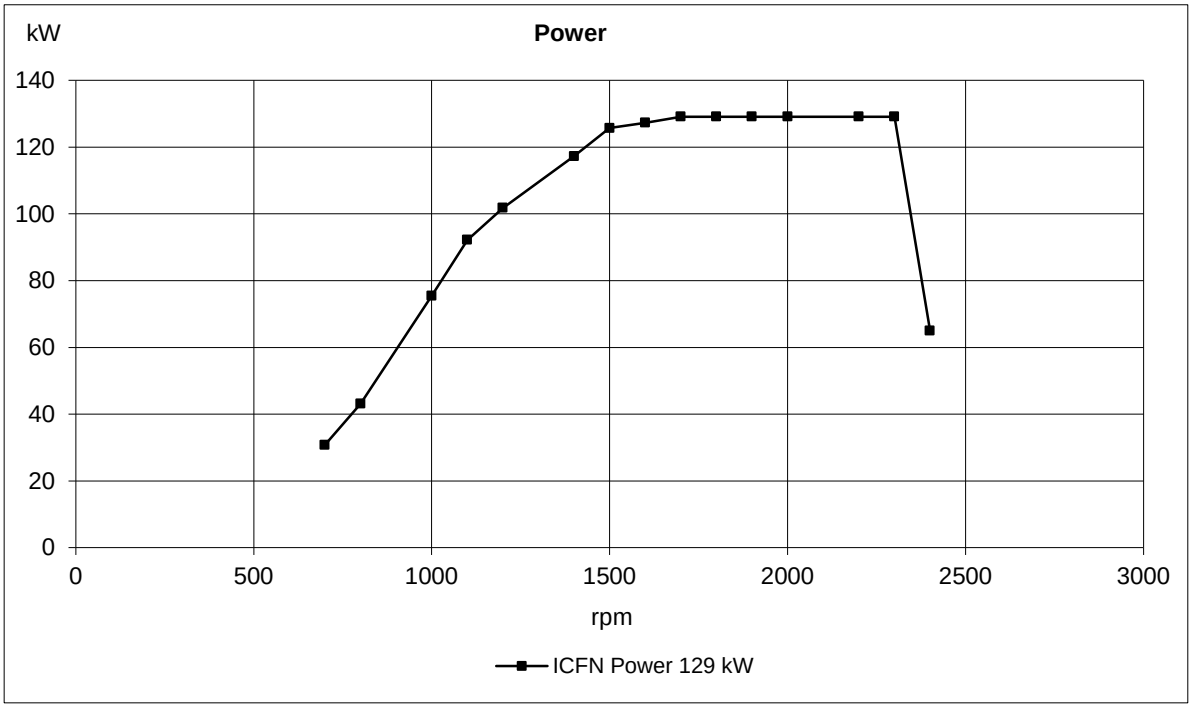
Electrical system

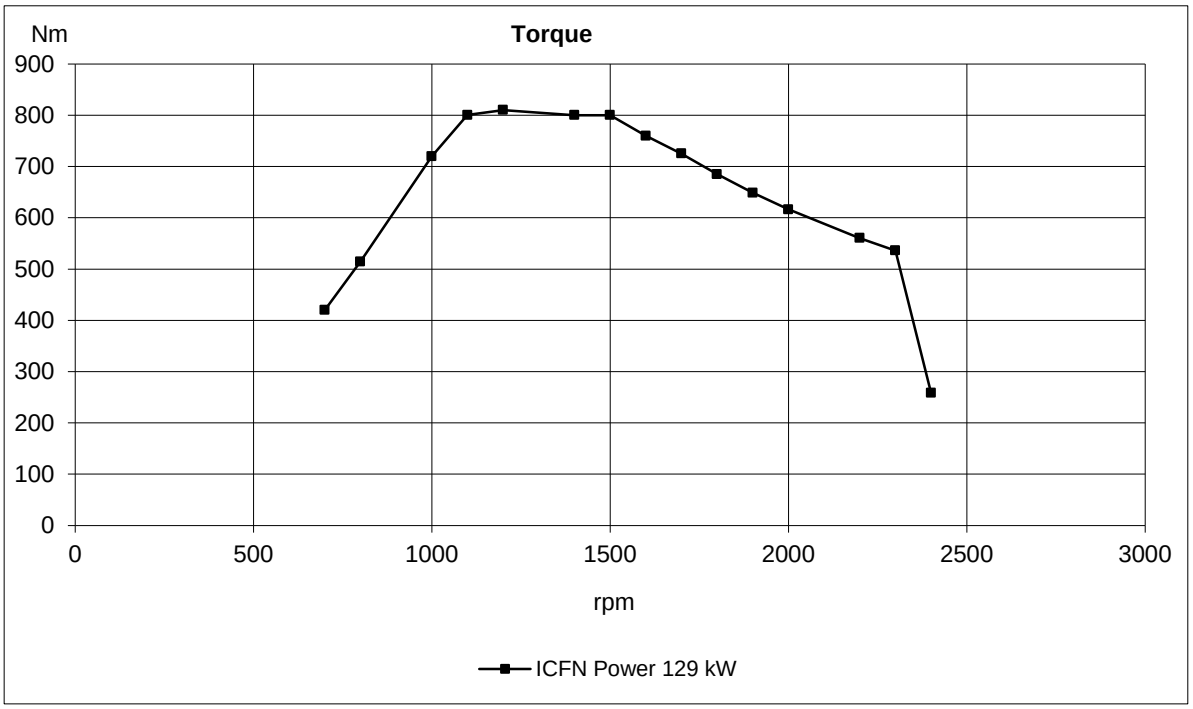
Voltage and type				24V
Alternator:	make			MELCO
	output	A		110/130
	tacho output	Hz/alternator rev.		
	drive ratio			
Starter motor:	make			MELCO
	type			**85P50**/90P55
	output		kW	5 / 5.5
			hp	6.8 / 7.5
Number of teeth on:	flywheel			137
	starter motor			10 / 12 teeth
Inlet manifold heater (at 20 V)			kW	4
Power relay for the manifold heater			A	200

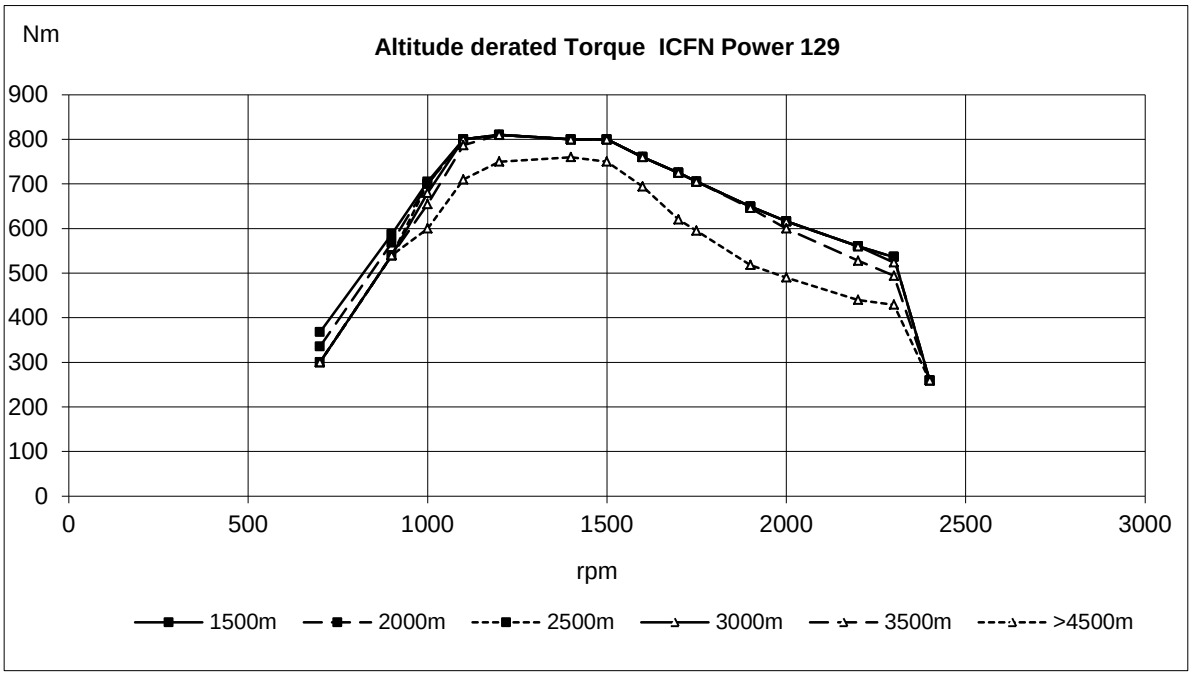
Conditions: (5 mΩ main circuit resistance@ 20°C)	**Temperature**	**°C**		**25**	**0**	**-15**
	Battery	**Ah / CCA**		**100/700**	**100/700**	**100/700**
Crank speed		rpm		197	150	123
Crank current		A		173	265	320
Starter input power during crank		kW		3,90	4,70	5,20
Battery power during crank		kW		4,00	5,10	5,70
Min battery @ 0°C		Ah / CCA				

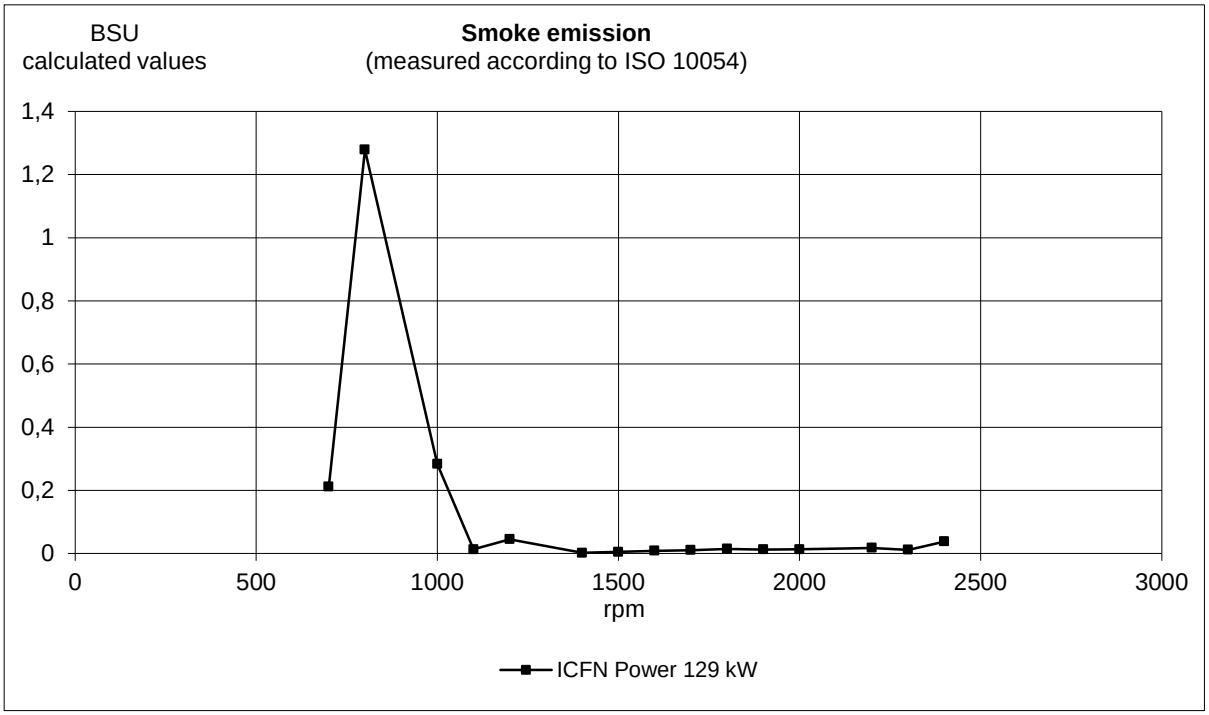
Power take off		**rpm**	**1400**	**1800**	**2000**	**2300**
Front end in line with crank shaft max:*	0.02 kgm^2	Nm	866	817	750	610
Flywheel		lbf ft	639	603	553	450
SAE 2, STD 10" & 11,5 ", 1.303 kgm2	0.03 kgm^2	Nm	866	748	711	457
		lbf ft	639	552	524	337
	0.04 kgm^2	Nm	866	695	645	399
		lbf ft	639	513	476	294
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	46	60	66	76
		hp	63	82	90	103
	max down	kW	35	45	49	57
		hp	48	61	67	78
	max right	kW	46	60	66	76
		hp	63	82	90	103
Maximum power on Rear PTO on top of flywheel housing(REPTO):*		kW	75			
		hp	102			
Speed ratio direction of rotation viewed from flywheel side			1:1 Counter clockwise			
Maximum torque on PTO at compressor position:*		Nm	200			
		lbf ft	148			
Speed ratio direction of rotation viewed from flywheel side			1.026:1 Counter clockwise			
Timing gear at hydraulic pump PTO max:*		Nm	80			
		lbf ft	59			
Speed ratio direction of rotation viewed from flywheel side			1.3:1 Clockwise			
Max allowed bending moment in flywheel housing	SAE2	Nm	4600			
		lbf ft	3393			
Max. rear main bearing load		N	5000			
		lbf	1124,0			

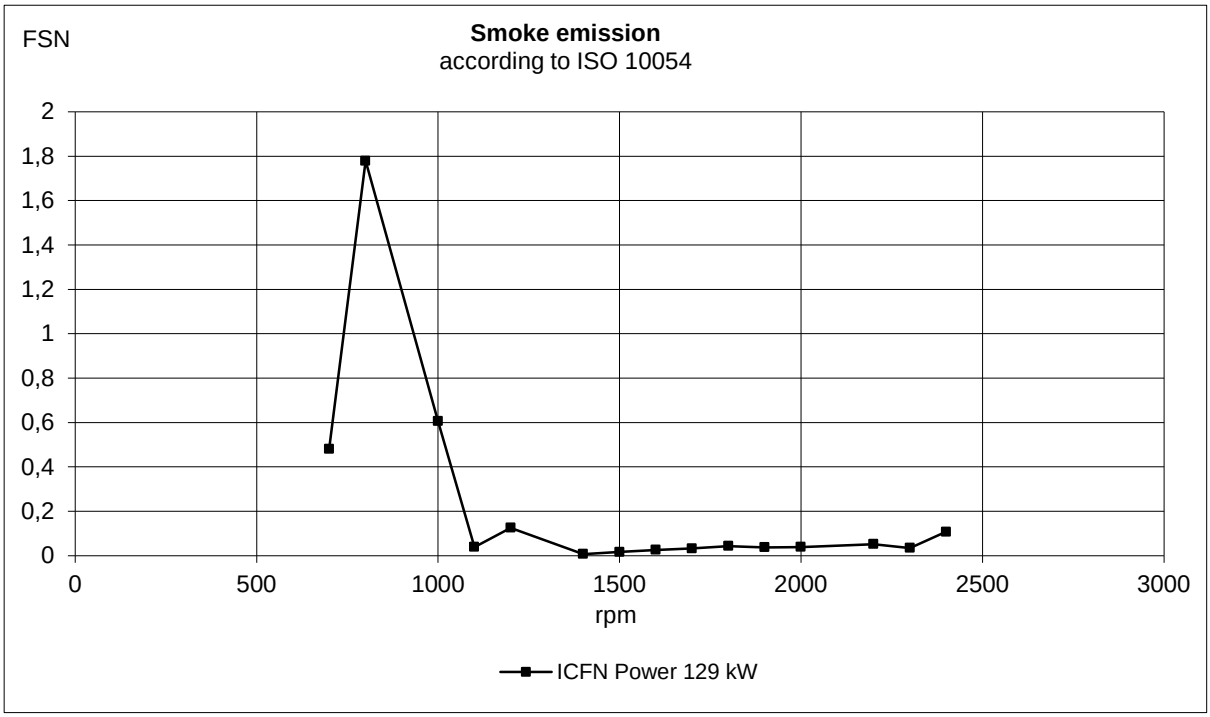
**** Maximum allowed torque at individual PTO´s.***
If more then one PTO output is used simultaniusly, calculations needs to be performed to determine available maximum. Available torque depends on application inertia.

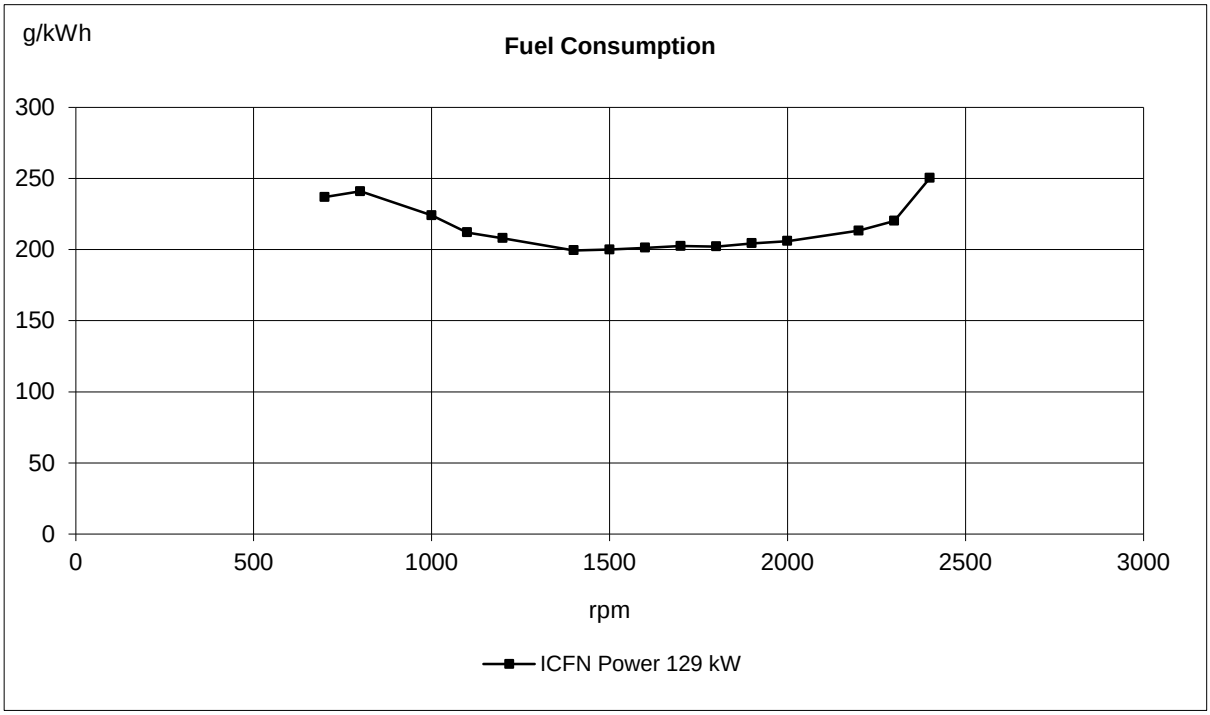

kW
Power
140
120
100
80
60
40
20
0
0
500
1000
1500
2000
2500
3000
rpm
ICFN Power 129 kW

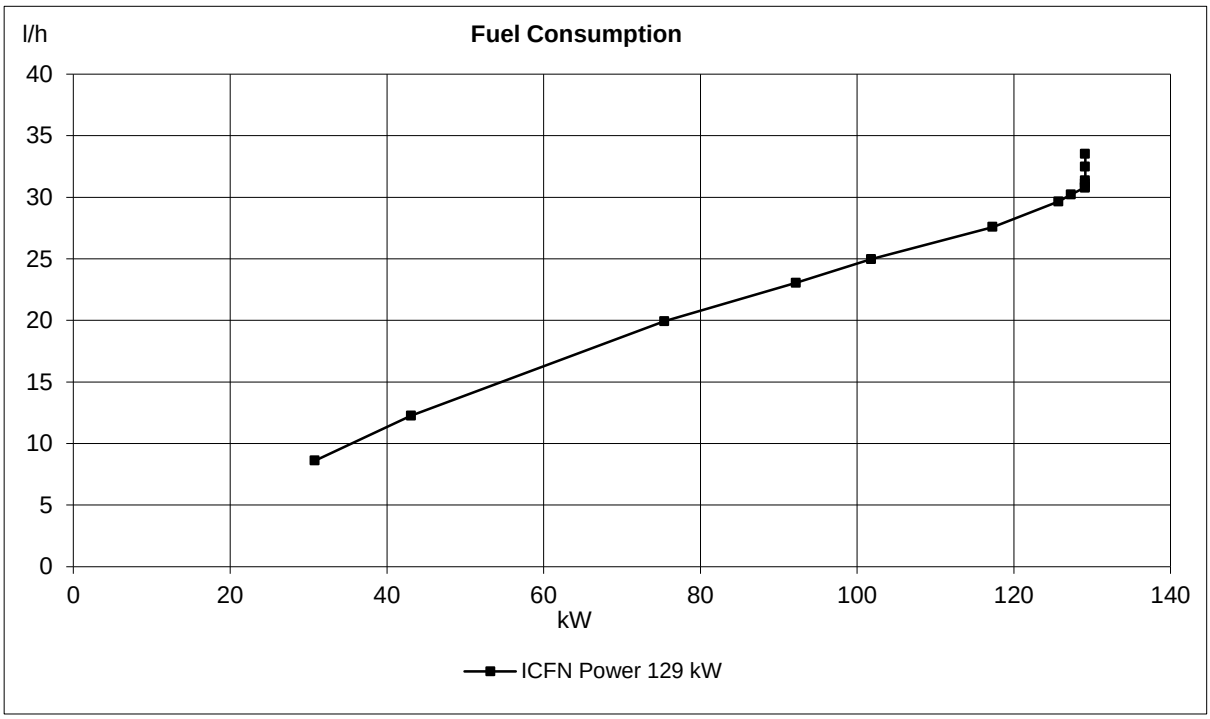

Nm
Torque
900
800
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
rpm
ICFN Power 129 kW

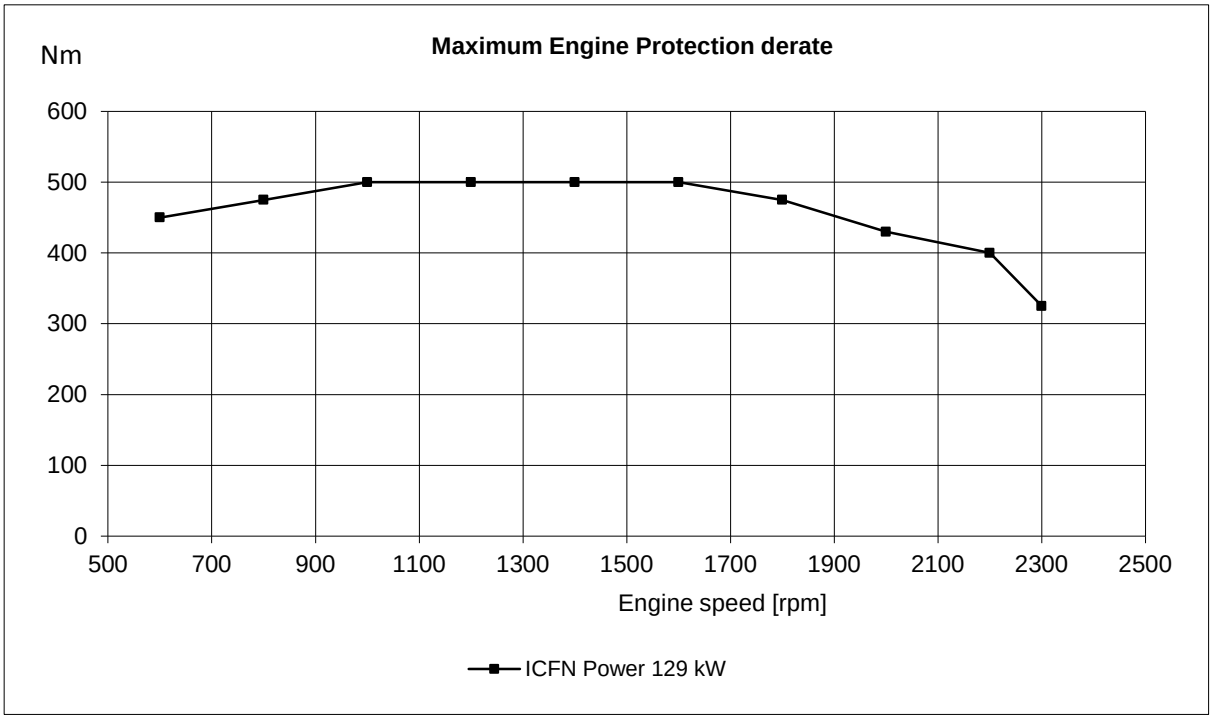

Nm
Altitude derated Torque ICFN Power 129
900
800
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
rpm
1500m
2000m
2500m
3000m
3500m
>4500m

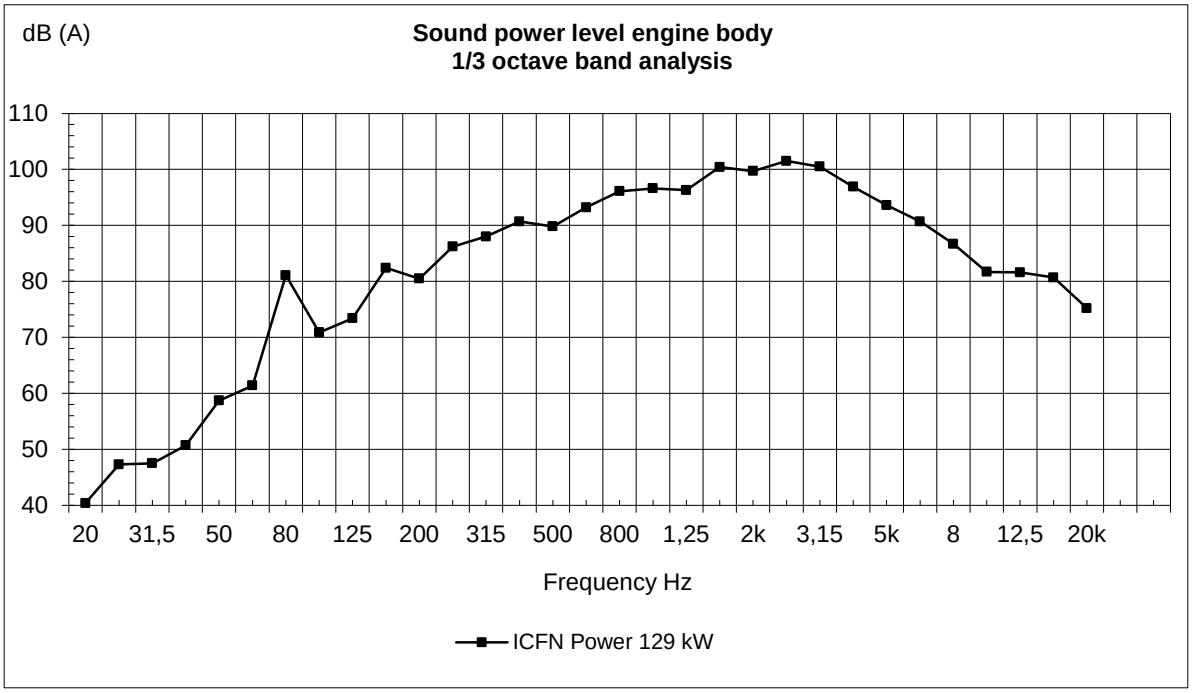

BSU
calculated values
Smoke emission
(measured according to ISO 10054)
1,4
1,2
1
0,8
0,6
0,4
0,2
0
0
500
1000
1500
2000
2500
3000
rpm
ICFN Power 129 kW

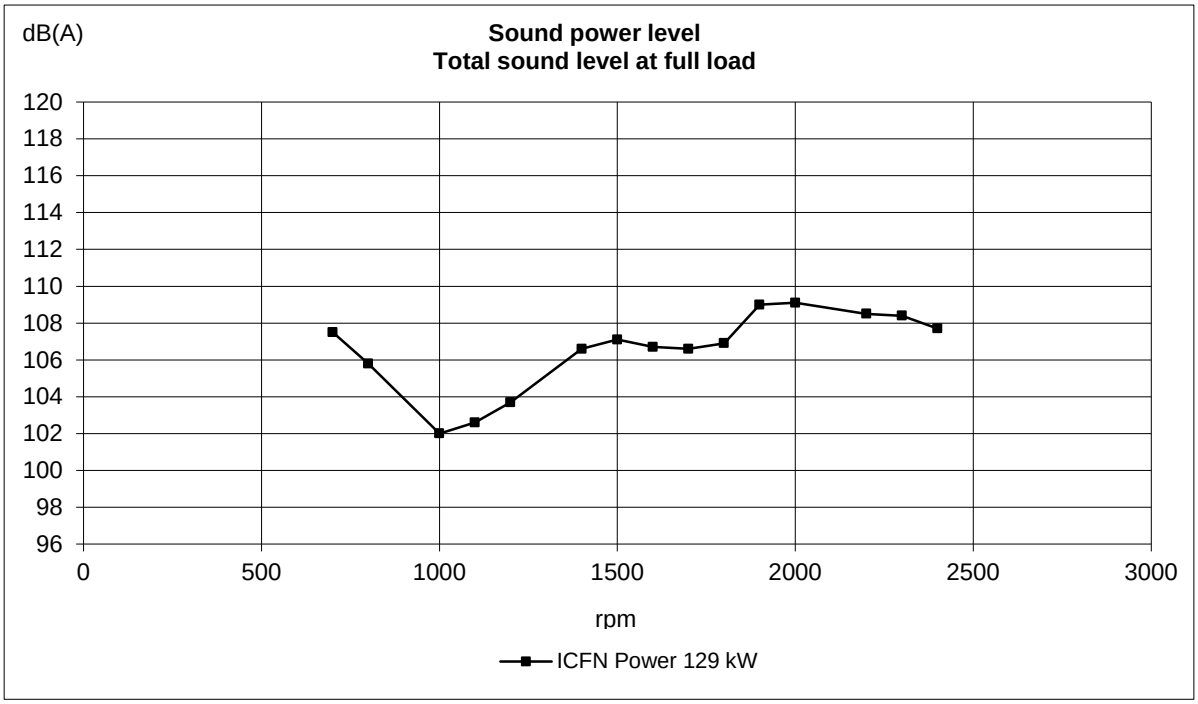

FSN
Smoke emission
according to ISO 10054
2
1,8
1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
0
500
1000
1500
2000
2500
3000
rpm
ICFN Power 129 kW

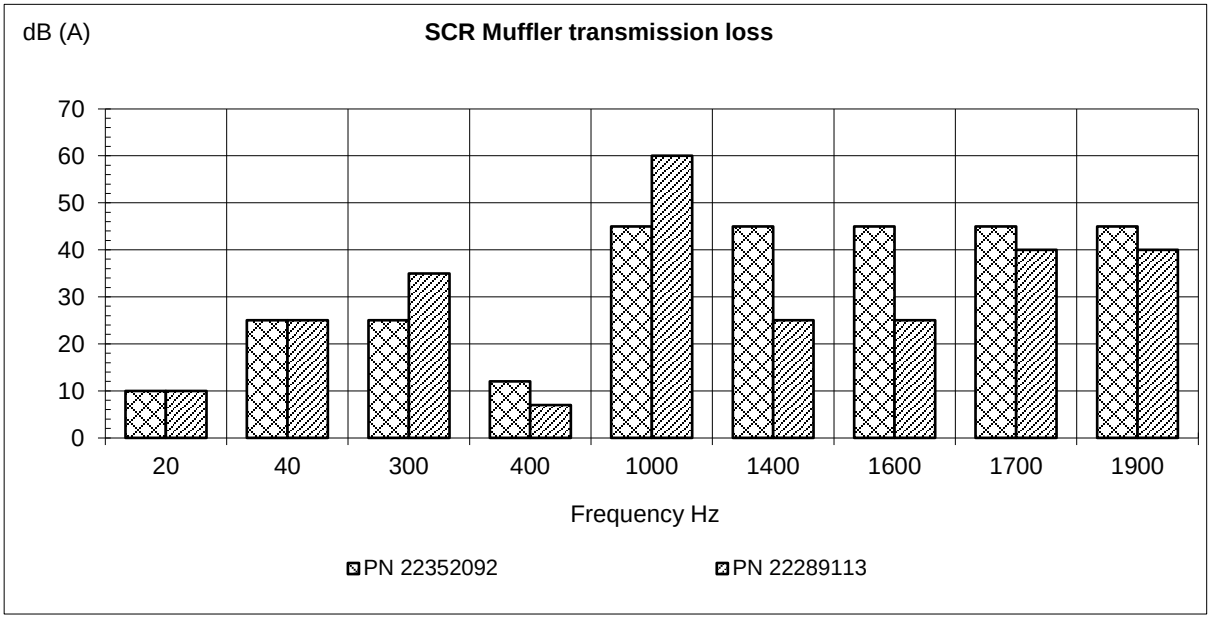

g/kWh
Fuel Consumption
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
rpm
ICFN Power 129 kW

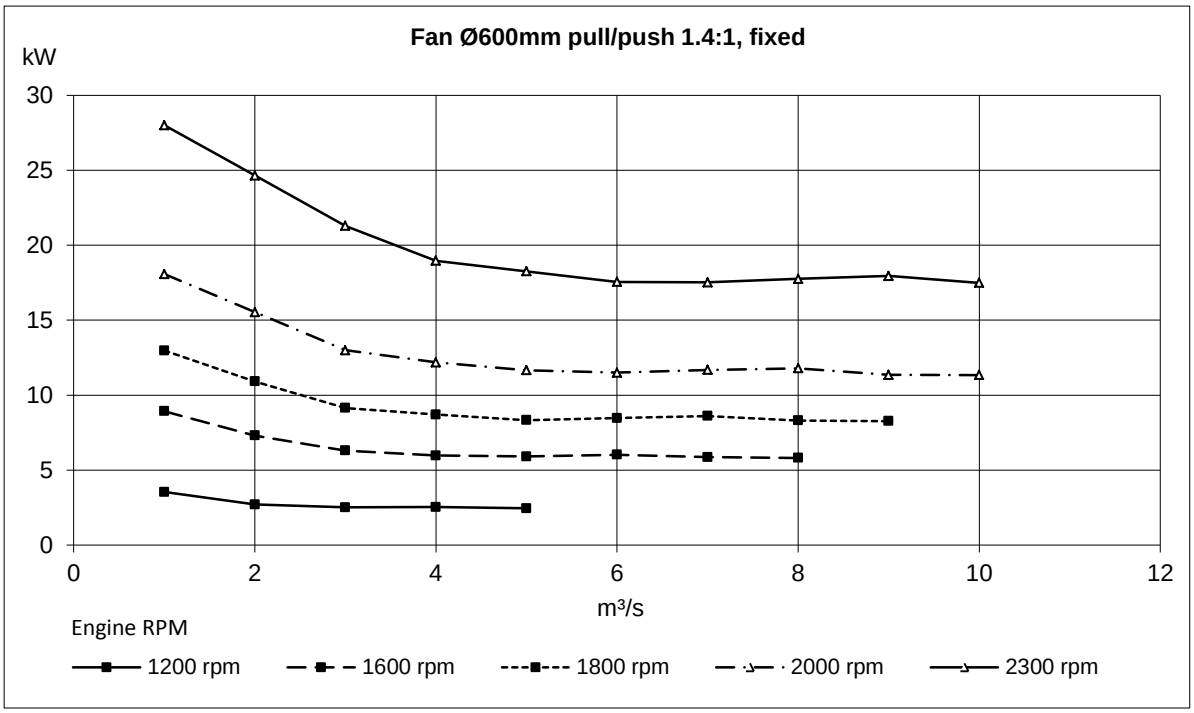

l/h
Fuel Consumption
40
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
140
kW
ICFN Power 129 kW

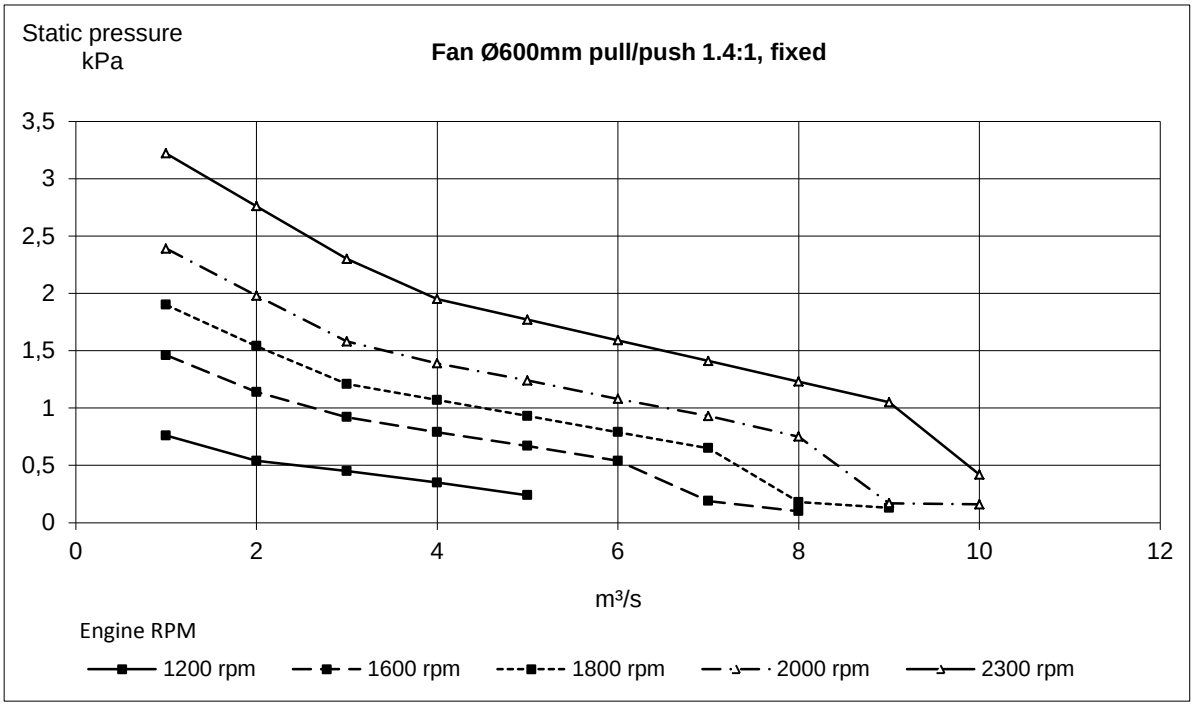

Maximum Engine Protection derate
Nm
600
500
400
300
200
100
0
500
700
900
1100
1300
1500
1700
1900
2100
2300
2500
Engine speed [rpm]
ICFN Power 129 kW

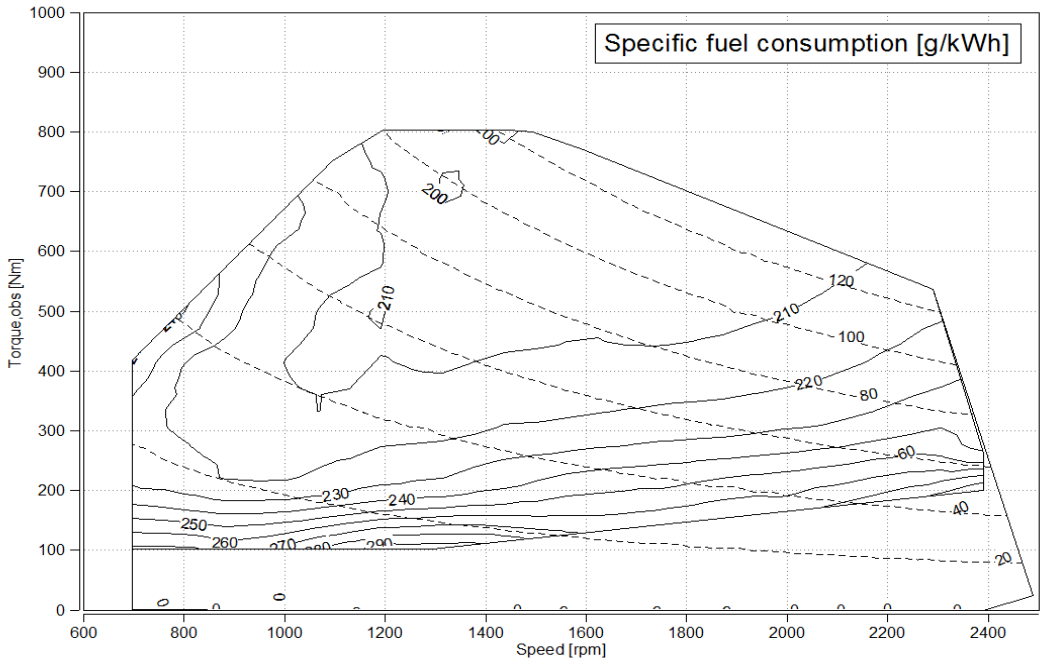

dB (A)
Sound power level engine body
1/3 octave band analysis
110
100
90
80
70
60
50
40
20
31,5
50
80
125
200
315
500
800
1,25
2k
3,15
5k
8
12,5
20k
Frequency Hz
ICFN Power 129 kW

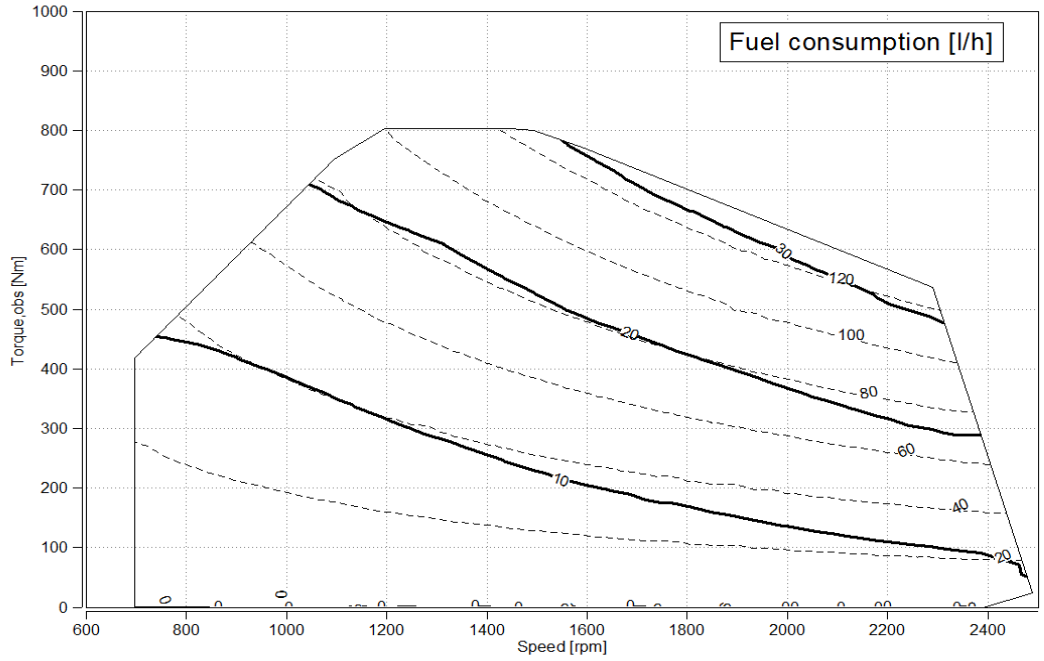

dB(A)
Sound power level
Total sound level at full load
120
118
116
114
112
110
108
106
104
102
100
98
96
0
500
1000
1500
2000
2500
3000
rpm
ICFN Power 129 kW


dB (A)
SCR Muffler transmission loss
70
60
50
40
30
20
10
0
20
40
300
400
1000
1400
1600
1700
1900
Frequency Hz
PN 22352092
PN 22289113


Fan Ø600mm pull/push 1.4:1, fixed
kW
30
25
20
15
10
5
0
0
2
4
6
8
10
12
m³/s
Engine RPM
1200 rpm
1600 rpm
1800 rpm
2000 rpm
2300 rpm


Static pressure
kPa
Fan Ø600mm pull/push 1.4:1, fixed
3,5
3
2,5
2
1,5
1
0,5
0
0
2
4
6
8
10
12
m³/s
Engine RPM
1200 rpm
1600 rpm
1800 rpm
2000 rpm
2300 rpm


Specific fuel consumption [g/kWh]
Torque,obs [Nm]
Speed [rpm]
1000
900
800
700
600
500
400
300
200
100
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
200
210
120
100
220
80
60
230
240
40
250
260
20

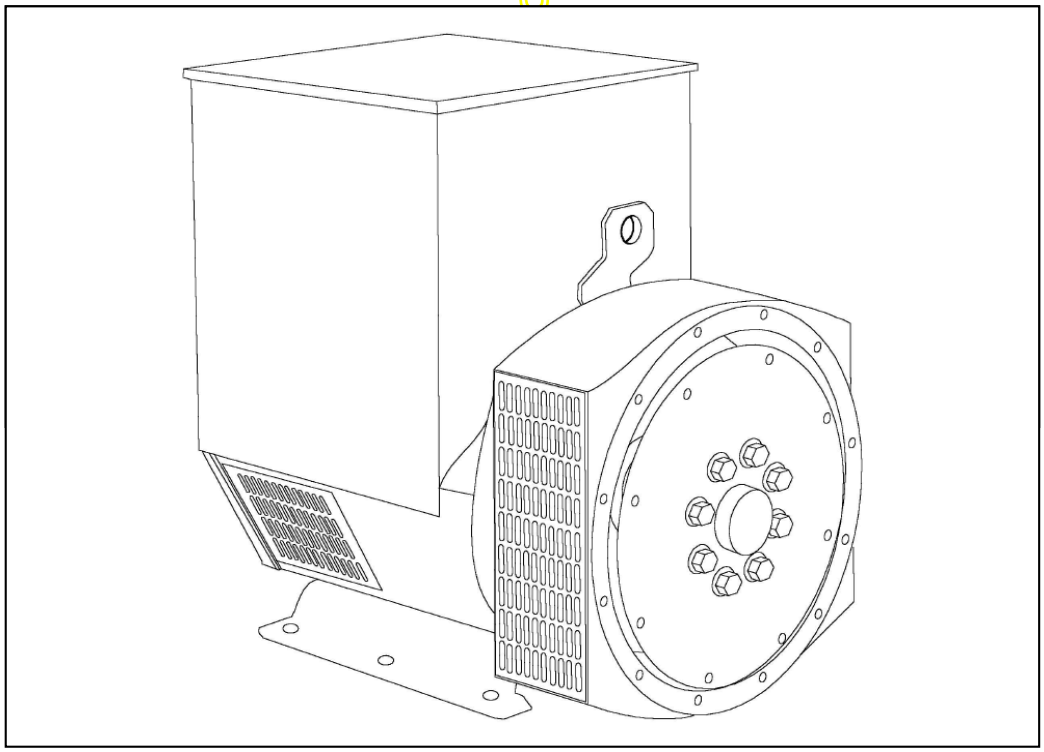

Fuel consumption [l/h]
Torque,obs [Nm]
Speed [rpm]
1000
900
800
700
600
500
400
300
200
100
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
30
120
20
100
80
60
10
40
20

STAMFORD®

UCI274E - Winding 06

Technical Data Sheet

ADP



SPECIFICATIONS & OPTIONS

STANDARDS
Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

SX460 AVR - STANDARD
With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

AS440 AVR
With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR
This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

MX321 AVR
The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally over voltage protection built-in and short circuit current level adjustments as an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th ...) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Dedicated Single Phase windings have 4 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to
BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5 C by which the operational ambient temperature exceeds 40 C.

Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

APPROVED DOCUMENT

WINDING 06

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX341	MX321	
VOLTAGE REGULATION	± 1%	± 0.5 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.0 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

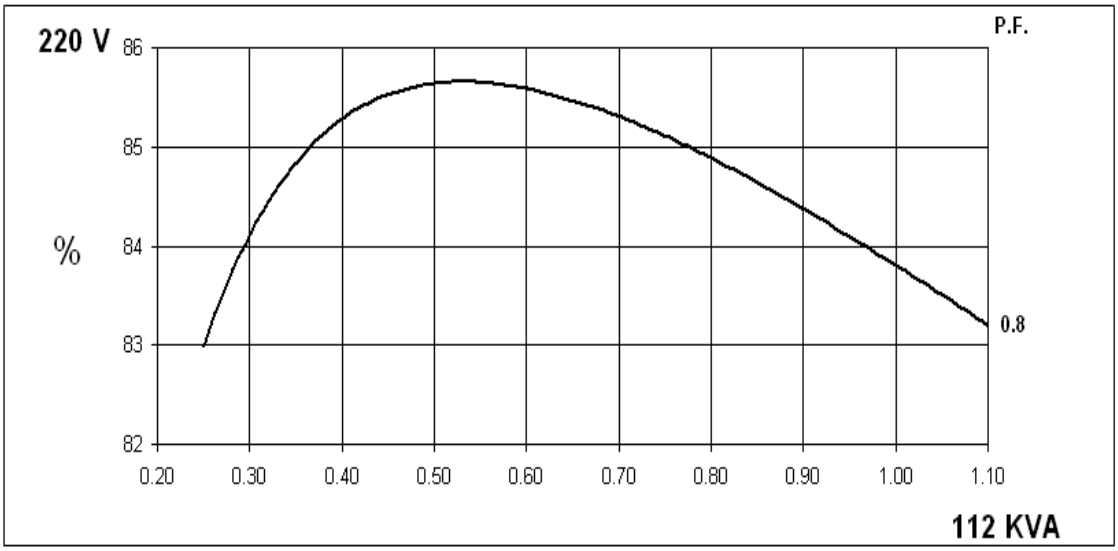
INSULATION SYSTEM	CLASS H					
PROTECTION	IP23					
RATED POWER FACTOR	0.8					
STATOR WINDING	SINGLE LAYER CONCENTRIC					
WINDING PITCH	TWO THIRDS					
WINDING LEADS	4					
MAIN STATOR RESISTANCE	0.015 Ohms AT 22°C SERIES CONNECTED					
MAIN ROTOR RESISTANCE	1.34 Ohms at 22°C					
EXCITER STATOR RESISTANCE	20 Ohms at 22°C					
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C					
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others					
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING LINEAR LOAD < 5.0%					
MAXIMUM OVERSPEED	2250 Rev/Min					
BEARING DRIVE END	BALL. 6315-2RS (ISO)					
BEARING NON-DRIVE END	BALL. 6310-2RS (ISO)					
	1 BEARING			2 BEARING		
WEIGHT COMP. GENERATOR	492 kg			511 kg		
WEIGHT WOUND STATOR	180 kg			180 kg		
WEIGHT WOUND ROTOR	167.51 kg			156.55 kg		
WR² INERTIA	1.3271 kgm^2			1.2765 kgm^2		
SHIPPING WEIGHTS in a crate	525 kg			539 kg		
PACKING CRATE SIZE	123 x 67 x 103(cm)			123 x 67 x 103(cm)		
TELEPHONE INTERFERENCE	THF<2%			TIF<50		
COOLING AIR	0.617 m³/sec 1308 cfm					
VOLTAGE SERIES	220		230		240	
VOLTAGE PARALLEL	110		115		120	
POWER FACTOR	0.8	1.0	0.8	1.0	0.8	1.0
kVA BASE RATING FOR REACTANCE VALUES	112	115	112	115	112	115
Xd DIR. AXIS SYNCHRONOUS	2.64	2.71	2.42	2.48	2.22	2.28
X'd DIR. AXIS TRANSIENT	0.25	0.26	0.23	0.24	0.21	0.22
X''d DIR. AXIS SUBTRANSIENT	0.17	0.17	0.15	0.15	0.14	0.14
Xq QUAD. AXIS REACTANCE	1.71	1.76	1.57	1.61	1.44	1.48
X''q QUAD. AXIS SUBTRANSIENT	0.21	0.22	0.20	0.21	0.18	0.18
X_L LEAKAGE REACTANCE	0.10	0.10	0.09	0.09	0.08	0.08
X_2 NEGATIVE SEQUENCE	0.19	0.20	0.17	0.17	0.16	0.16
X_0 ZERO SEQUENCE	0.11	0.11	0.10	0.10	0.09	0.09
REACTANCES ARE SATURATED						
T'd TRANSIENT TIME CONST.	0.032s					
T''d SUB-TRANSTIME CONST.	0.01s					
T'do O.C. FIELD TIME CONST.	0.85s					
Ta ARMATURE TIME CONST.	0.007s					
SHORT CIRCUIT RATIO	1/Xd					

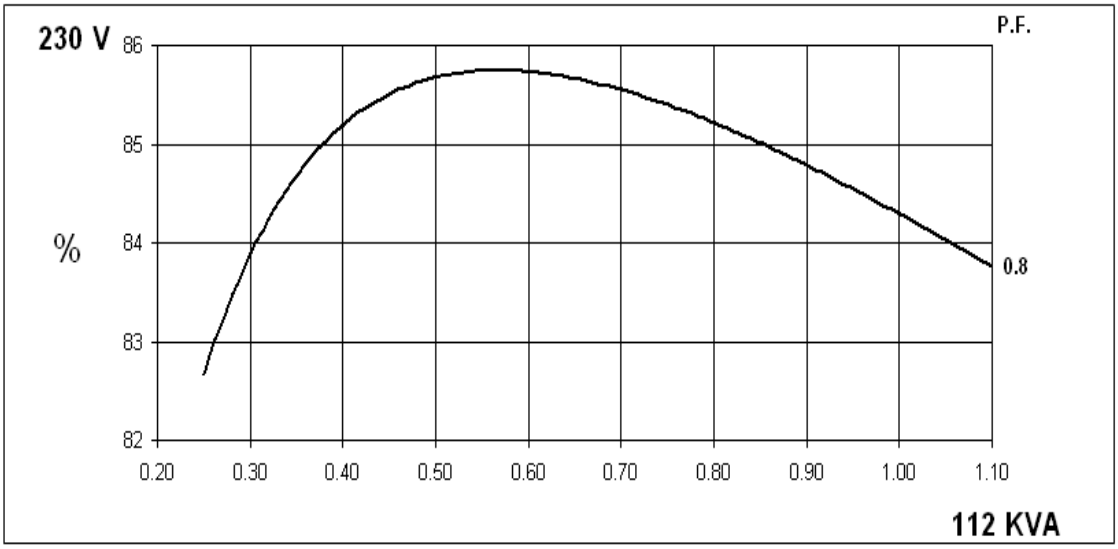
APPROVED DOCUMENT

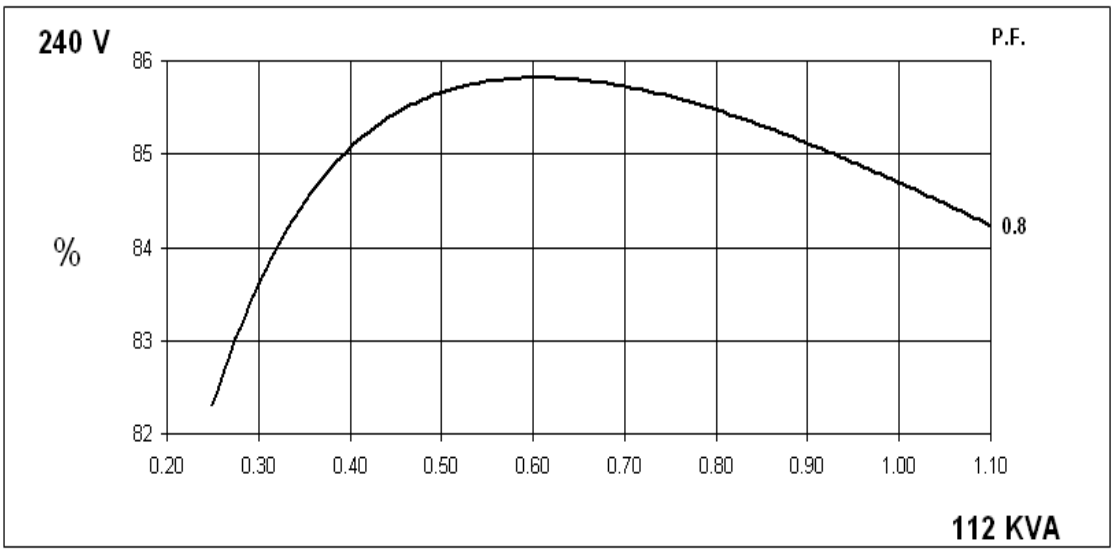
UCI274E

Winding 06 / 0.8pf

SINGLE PHASE EFFICIENCY CURVES



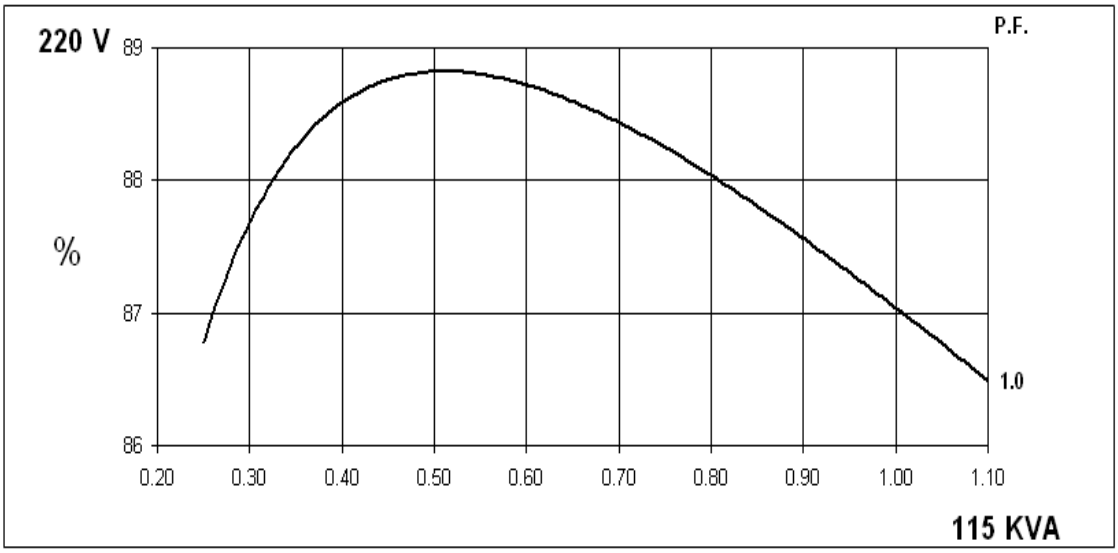


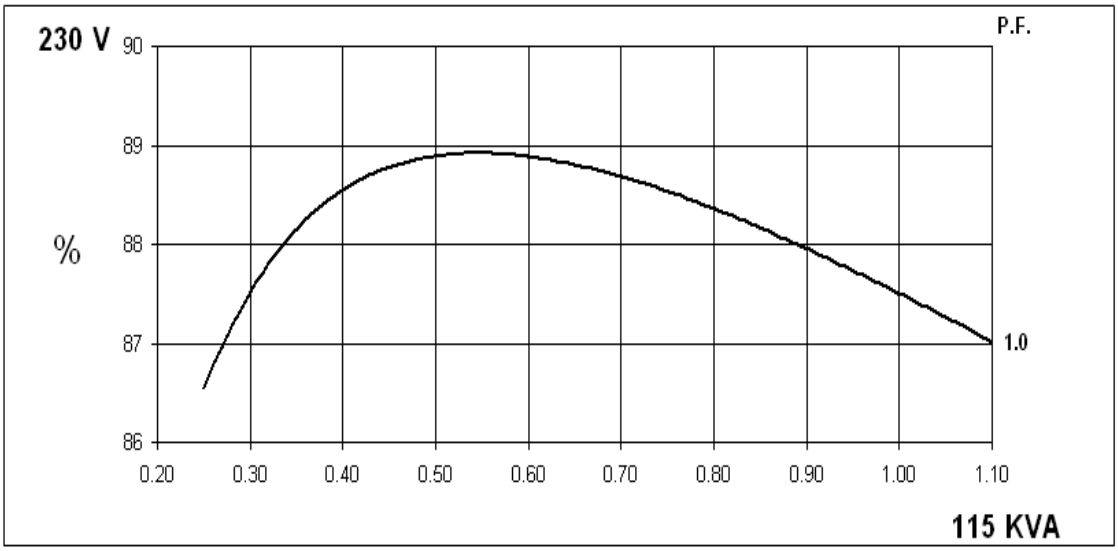


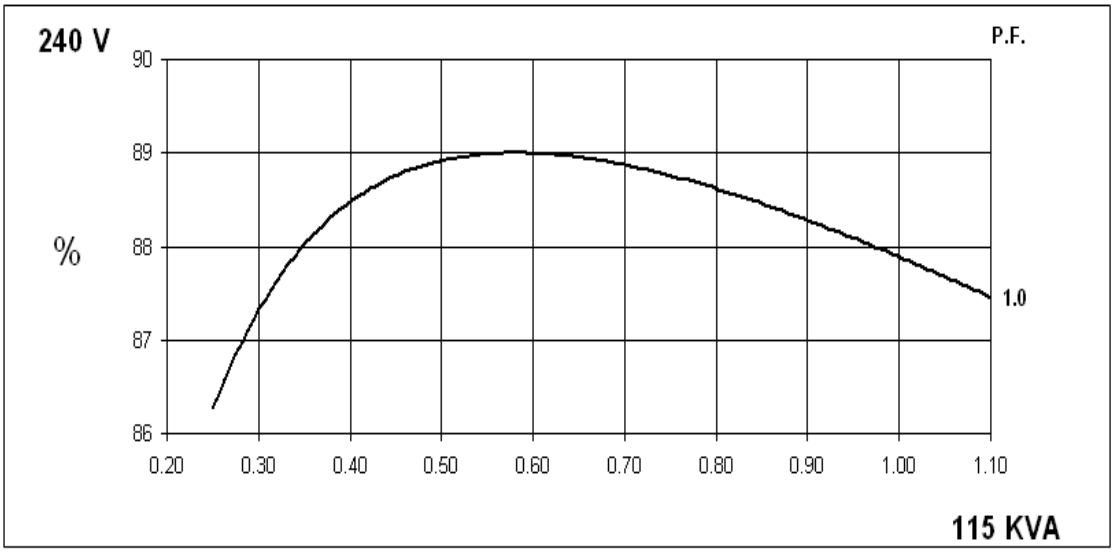
UCI274E

Winding 06 / 1.0pf

SINGLE PHASE EFFICIENCY CURVES





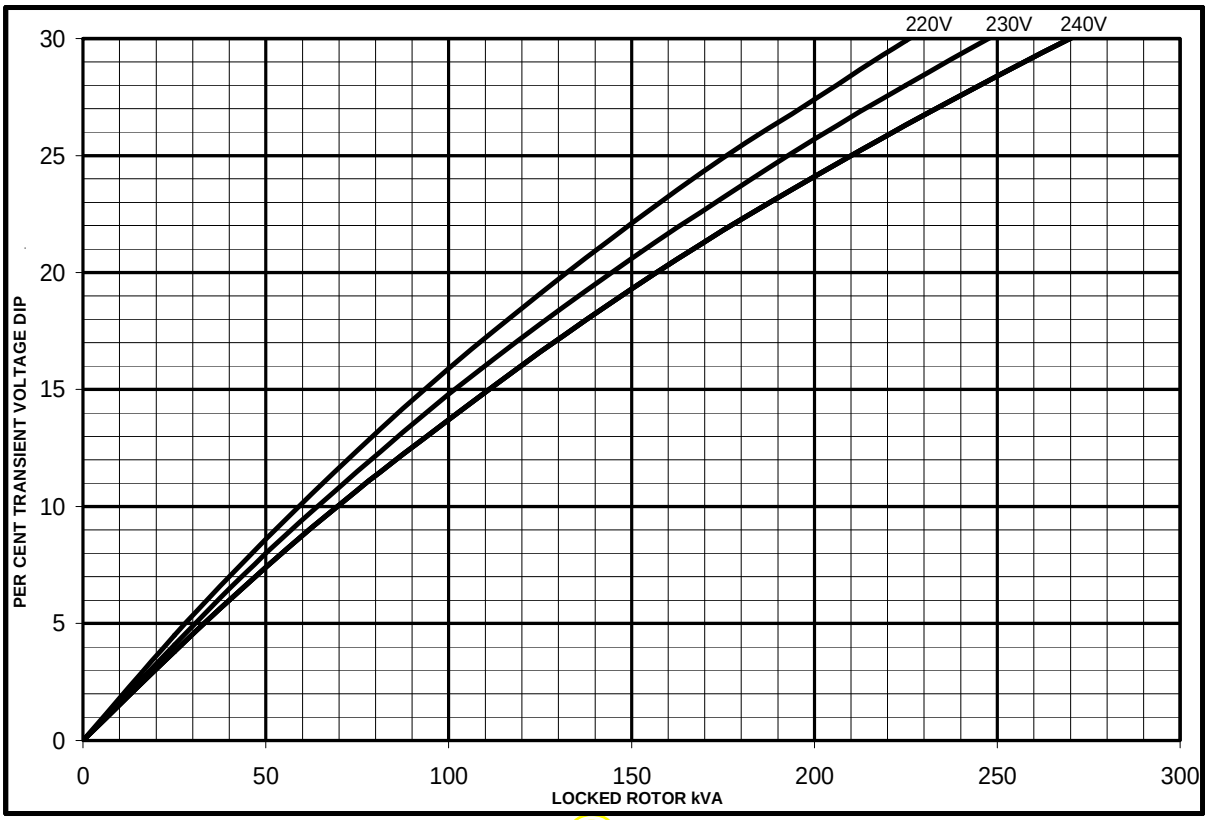


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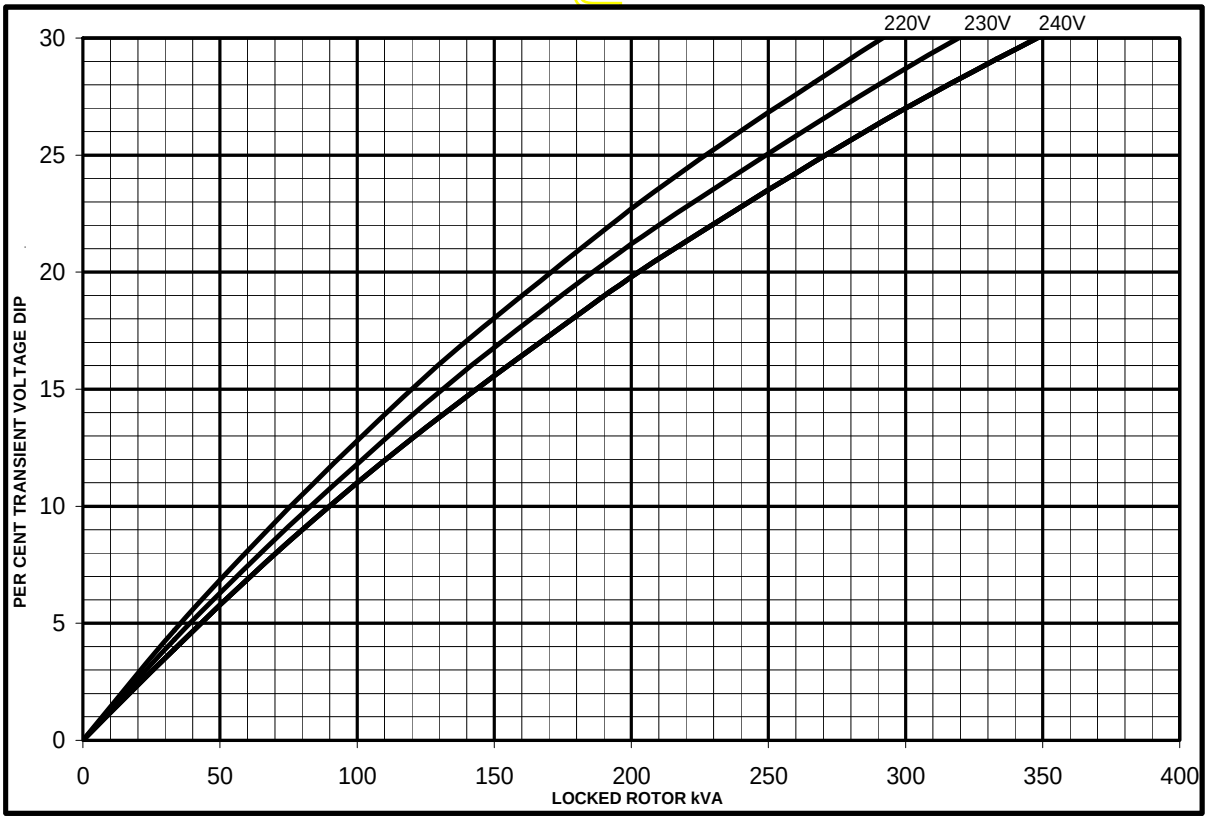
Winding 06

SX

Locked Rotor Motor Starting Curves

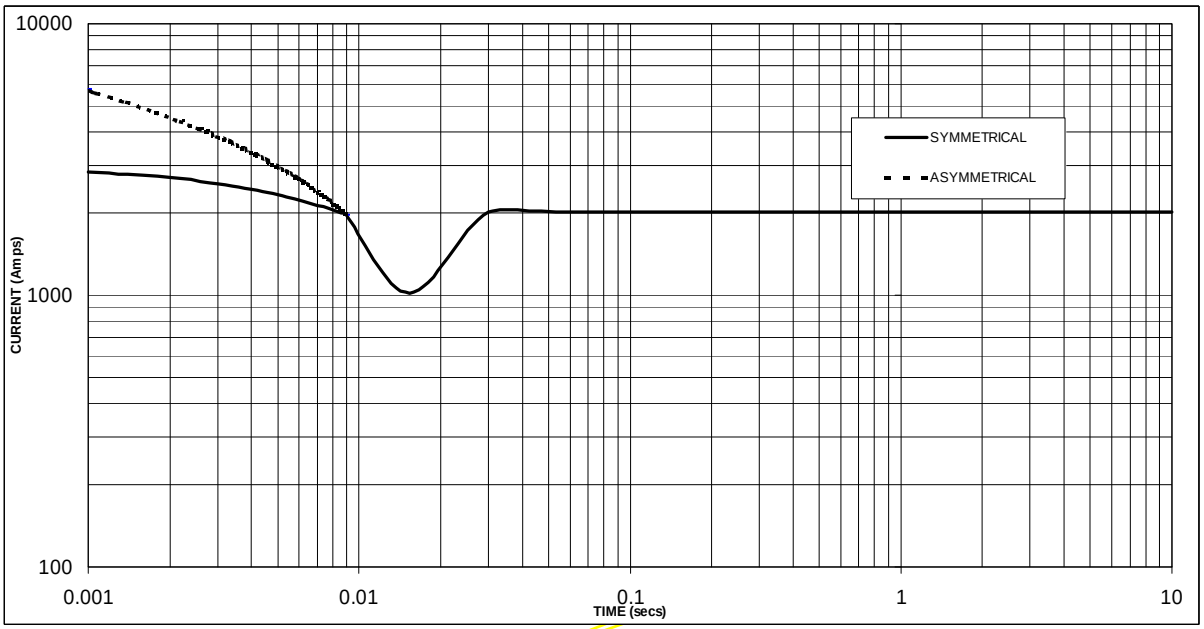


MX



STAMFORD

Short Circuit Decrement Curve. No-load Excitation at Rated Speed
Based on series connection.



Sustained Short Circuit = 2030 Amps

OBSOLETE
SUPERSEDED

Note
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

Voltage	Factor
220V	X 1.00
230V	X 1.05
240V	X 1.09

The sustained current value is constant irrespective of voltage level

UCI274E

Winding 06

STAMFORD

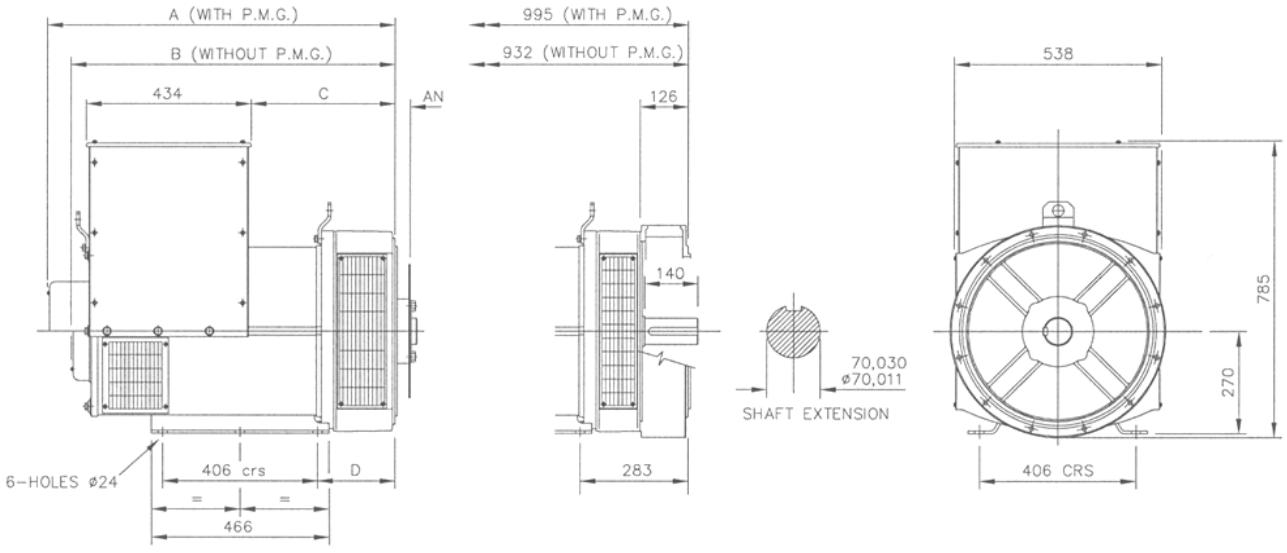
60Hz

RATINGS

Class - Temp Rise	Cont. F - 105/40°C **0.8pf**			Cont. H - 125/40°C **0.8pf**			Cont. F - 105/40°C **1.0pf**			Cont. H - 125/40°C **1.0pf**		
Series (V)	220	230	240	220	230	240	220	230	240	220	230	240
Parallel (V)	110	115	120	110	115	120	110	115	120	110	115	120
kVA	100.0	100.0	100.0	112.0	112.0	112.0	100.0	100.0	100.0	115.0	115.0	115.0
kW	80.0	80.0	80.0	89.6	89.6	89.6	100.0	100.0	100.0	115.0	115.0	115.0
Efficiency (%)	84.4	84.8	85.1	83.8	84.3	84.7	87.7	88.1	88.4	87.0	87.5	87.9
kW Input	94.8	94.3	94.0	106.9	106.3	105.8	114.0	113.5	113.1	132.2	131.4	130.8

APPROVE

DIMENSIONS



SINGLE BEARING ADAPTORS				
ADAPTOR	A	B	C	D
SAE 1	928,3	865,3	389,3	216,3
SAE 2	914	851	375	202
SAE 3	914	851	375	202

COUPLING DISCS	
DISC	AN
SAE 10	53,98
SAE 11,5	39,68
SAE 14	25,40

APPROVED DOCUMENT

STAMFORD

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Lincolnshire, PE9 2NB
United Kingdom
Tel: +44 (0) 1780 484000
Fax: +44 (0) 1780 484100

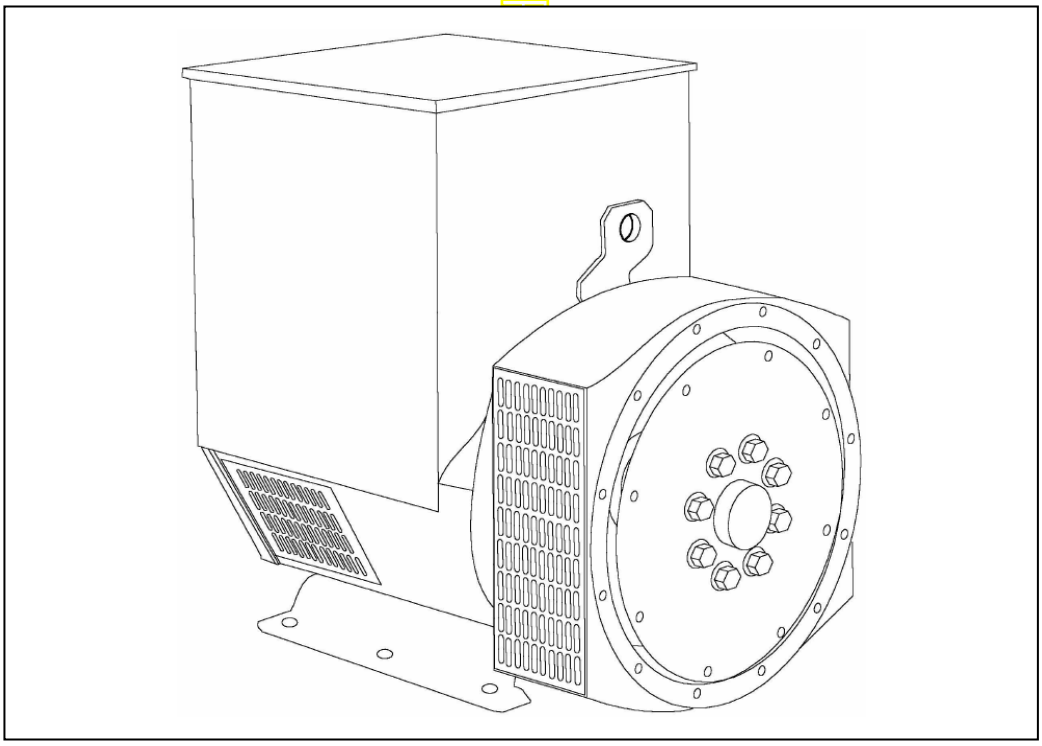
www.cumminsgeneratortechnologies.com

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STAMFORD®

UCI274E - Winding 311

Technical Data Sheet



SPECIFICATIONS & OPTIONS

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

SX460 AVR - STANDARD

With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

AS440 AVR

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
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MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.
If three-phase sensing is required with the PMG system the MX321 AVR must be used.
We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

APPROVED DOCUMENT

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation.
Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5°C by which the operational ambient temperature exceeds 40°C.
Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.0 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H							
PROTECTION	IP23							
RATED POWER FACTOR	0.8							
STATOR WINDING	DOUBLE LAYER CONCENTRIC							
WINDING PITCH	TWO THIRDS							
WINDING LEADS	12							
STATOR WDG. RESISTANCE	0.0317 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED							
ROTOR WDG. RESISTANCE	1.34 Ohms at 22°C							
EXCITER STATOR RESISTANCE	20 Ohms at 22°C							
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C							
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others							
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
MAXIMUM OVERSPEED	2250 Rev/Min							
BEARING DRIVE END	BALL. 6315-2RS (ISO)							
BEARING NON-DRIVE END	BALL. 6310-2RS (ISO)							
	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	492 kg				511 kg			
WEIGHT WOUND STATOR	180 kg				180 kg			
WEIGHT WOUND ROTOR	167.51 kg				156.55 kg			
WR² INERTIA	1.3271 kgm²				1.2765 kgm²			
SHIPPING WEIGHTS in a crate	525 kg				539 kg			
PACKING CRATE SIZE	123 x 67 x 103(cm)				123 x 67 x 103(cm)			
	50 Hz				60 Hz			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	0.514 m³/sec 1090 cfm				0.617 m³/sec 1308 cfm			
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
kVA BASE RATING FOR REACTANCE VALUES	140	140	140	N/A	160	167.5	167.5	178.8
Xd DIR. AXIS SYNCHRONOUS	2.34	2.11	1.96	-	2.68	2.51	2.29	2.25
X'd DIR. AXIS TRANSIENT	0.21	0.19	0.18	-	0.25	0.23	0.21	0.21
X"d DIR. AXIS SUBTRANSIENT	0.14	0.13	0.12	-	0.17	0.16	0.15	0.14
Xq QUAD. AXIS REACTANCE	1.53	1.38	1.28	-	1.74	1.63	1.49	1.46
X"q QUAD. AXIS SUBTRANSIENT	0.18	0.16	0.15	-	0.22	0.21	0.19	0.18
X_L LEAKAGE REACTANCE	0.08	0.08	0.07	-	0.09	0.08	0.08	0.08
X_2 NEGATIVE SEQUENCE	0.16	0.14	0.13	-	0.19	0.18	0.16	0.16
X_0 ZERO SEQUENCE	0.10	0.09	0.08	-	0.11	0.10	0.09	0.09
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED							
T'd TRANSIENT TIME CONST.	0.032 s							
T"d SUB-TRANSTIME CONST.	0.01 s							
T'do O.C. FIELD TIME CONST.	0.85 s							
Ta ARMATURE TIME CONST.	0.007 s							
SHORT CIRCUIT RATIO	1/Xd							

APPROVED DOCUMENT

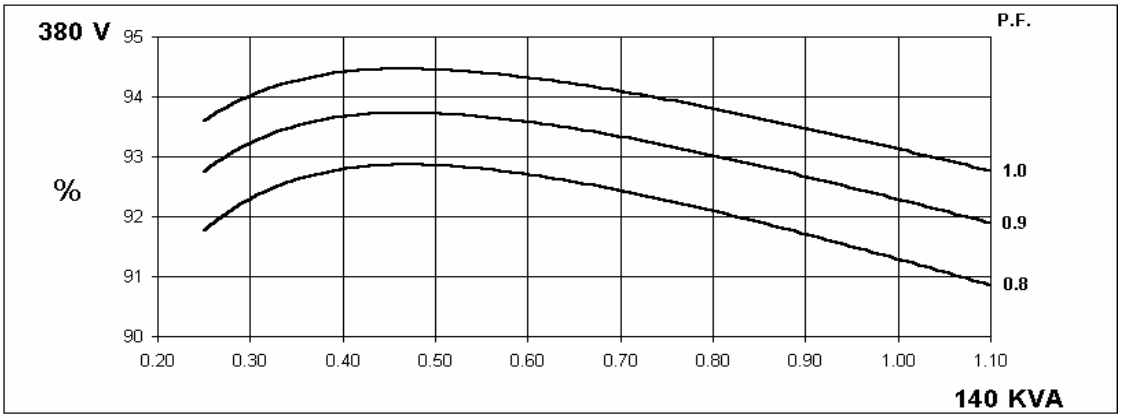
50 Hz

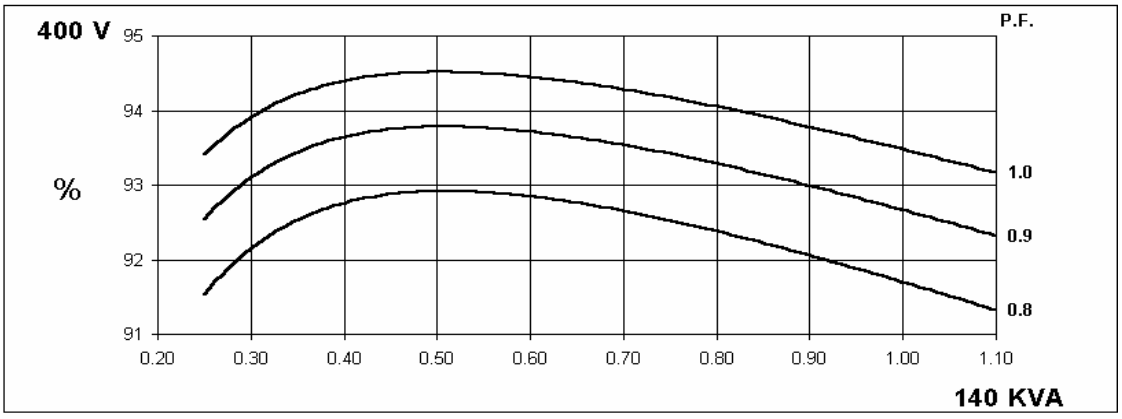
UCI274E

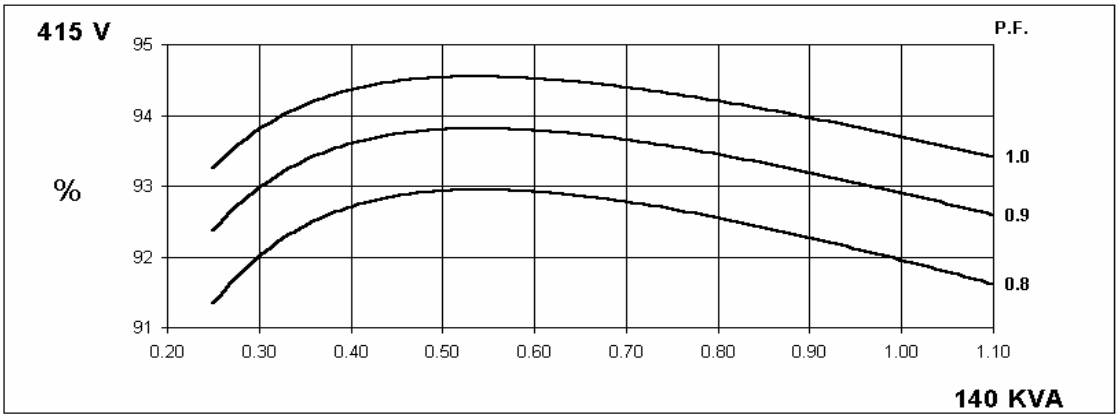
Winding 311

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THREE PHASE EFFICIENCY CURVES







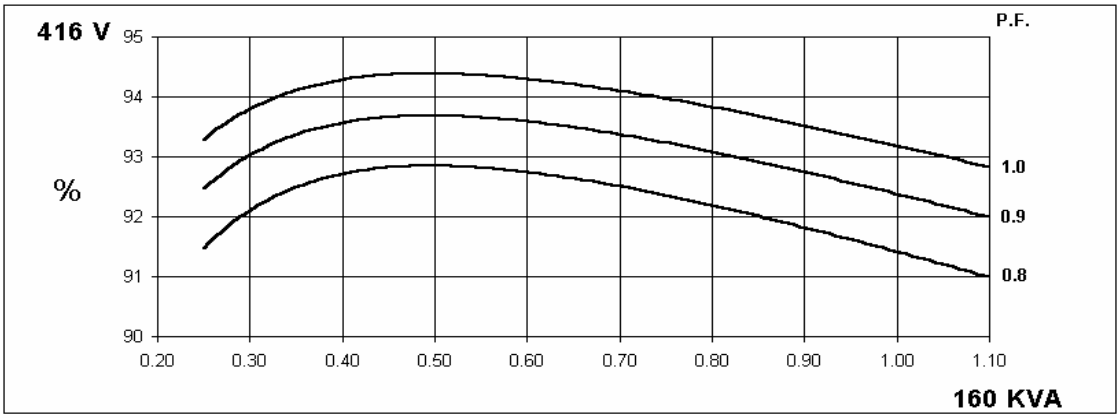
60 Hz

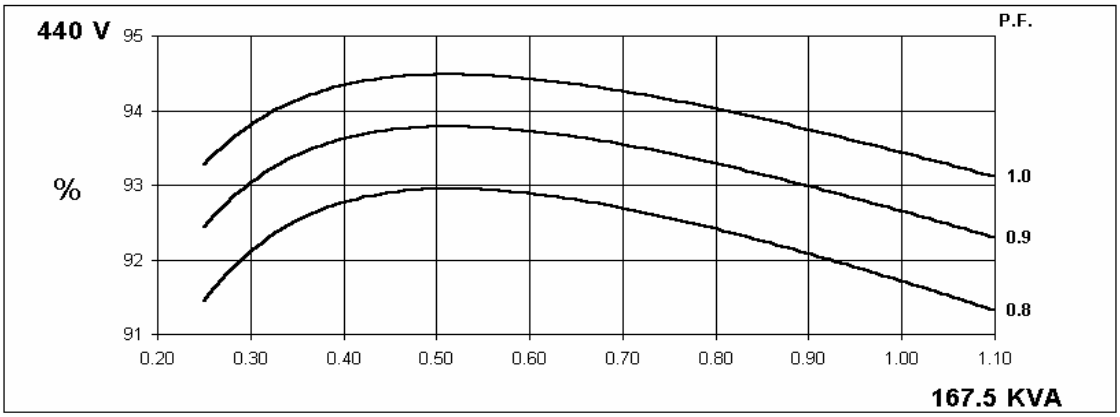
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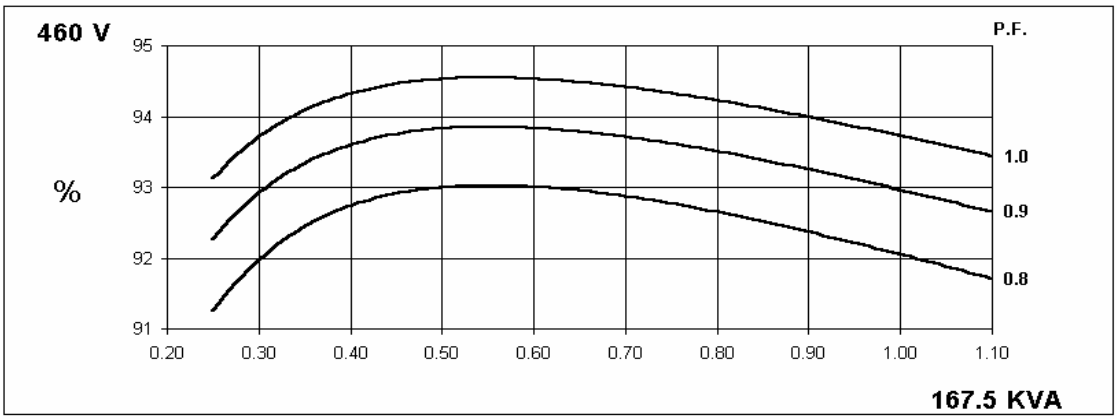
Winding 311

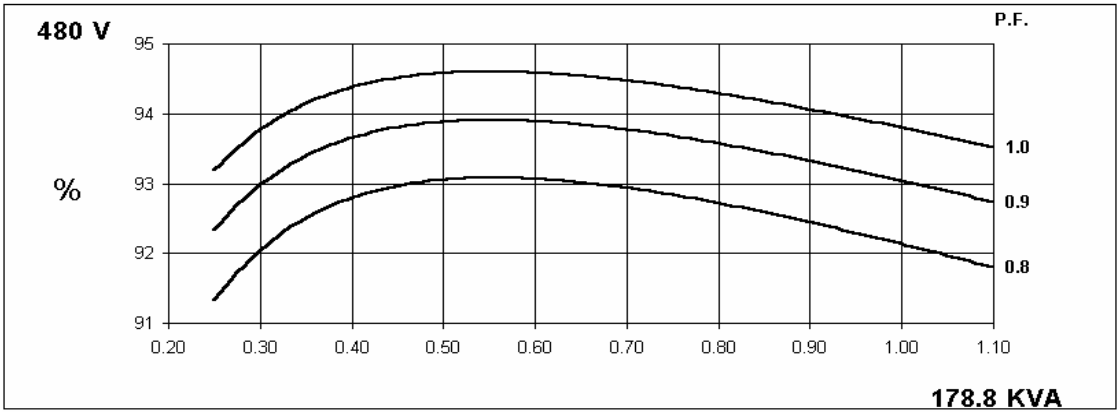
STAMFORD

THREE PHASE EFFICIENCY CURVES









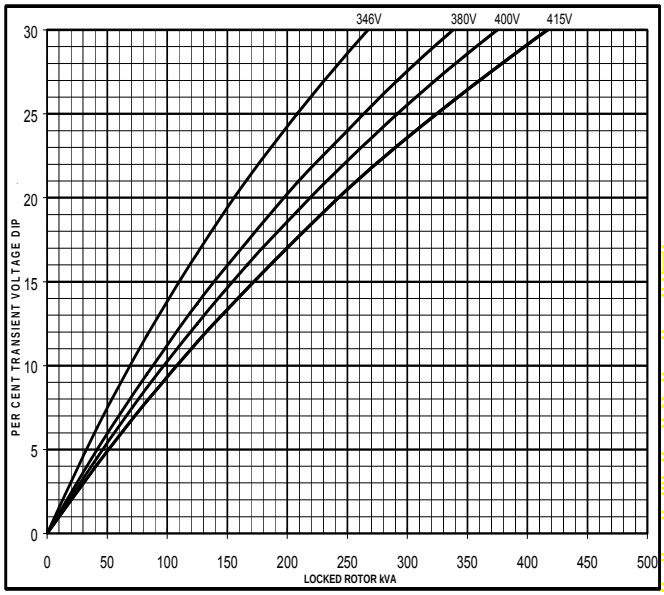
UCI274E

Winding 311

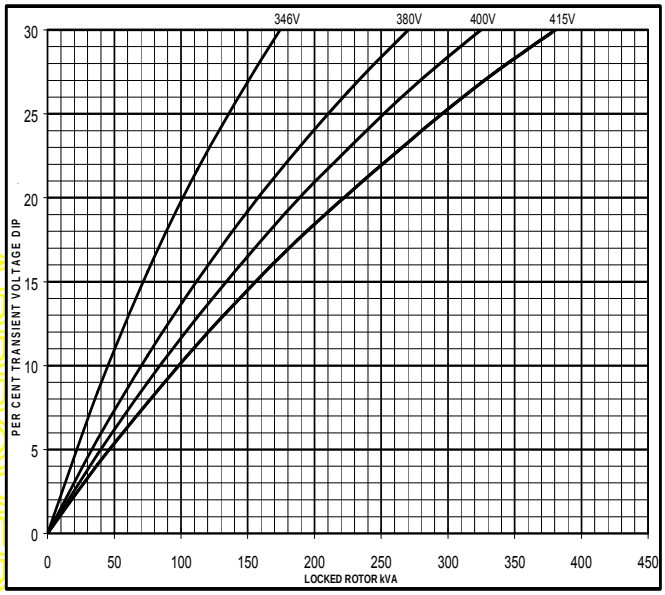
Locked Rotor Motor Starting Curve

50 Hz

MX

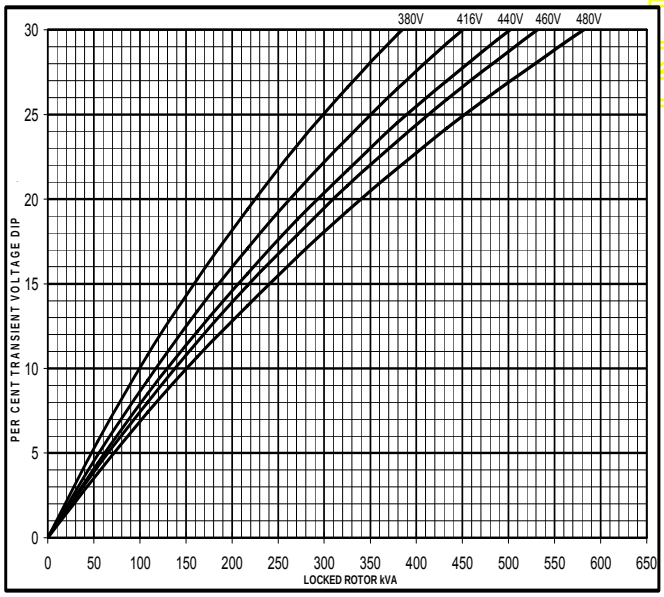


SX

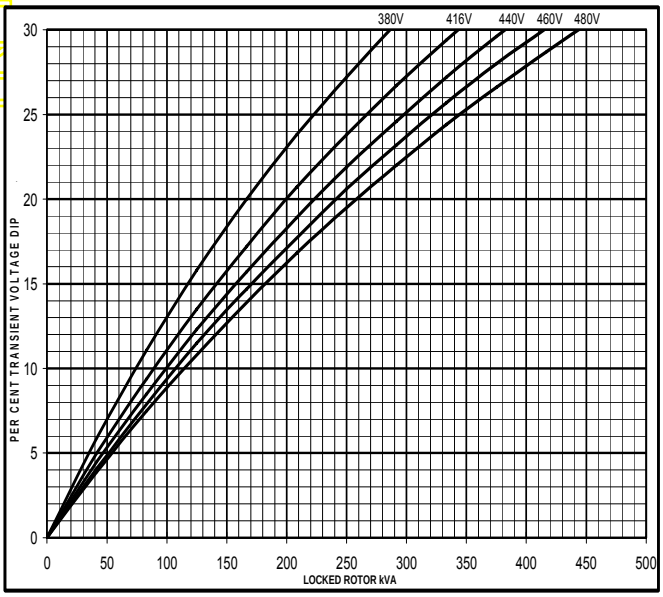


60 Hz

MX



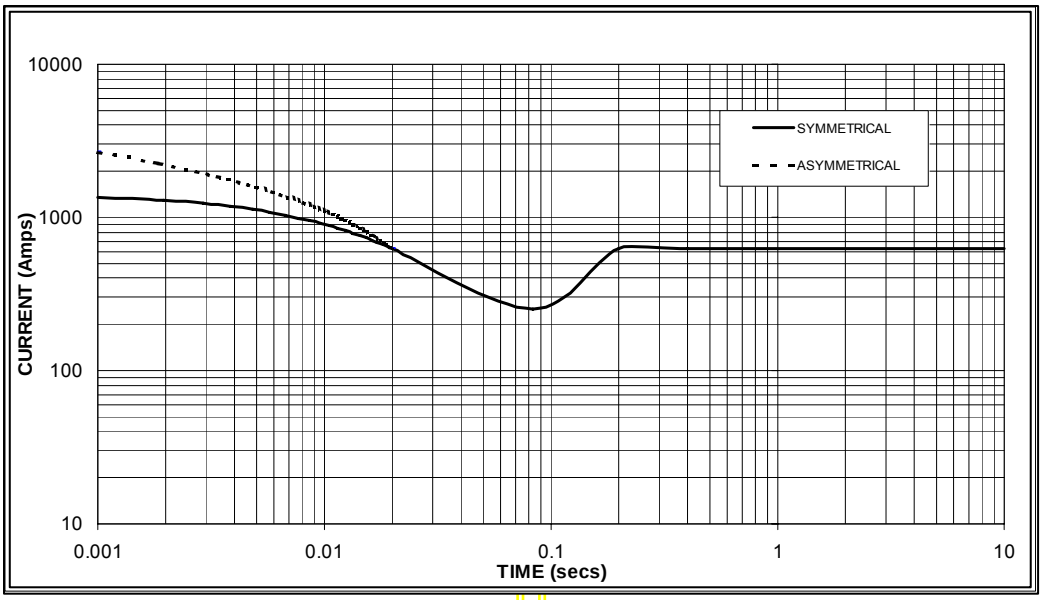
SX



OBSOLETE
DO NOT USE

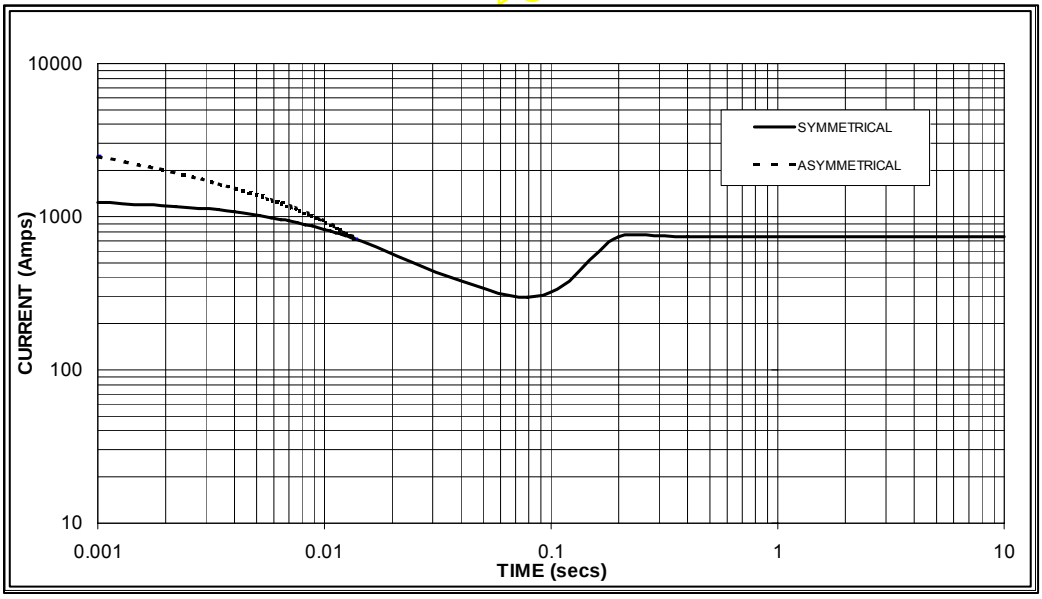
Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 630 Amps

60 Hz



Sustained Short Circuit = 740 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	X 1.00	416v	X 1.00
400v	X 1.07	440v	X 1.06
415v	X 1.12	460v	X 1.12
		480v	X 1.17

The sustained current value is constant irrespective of voltage level

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines. For other connection the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

UCI274E

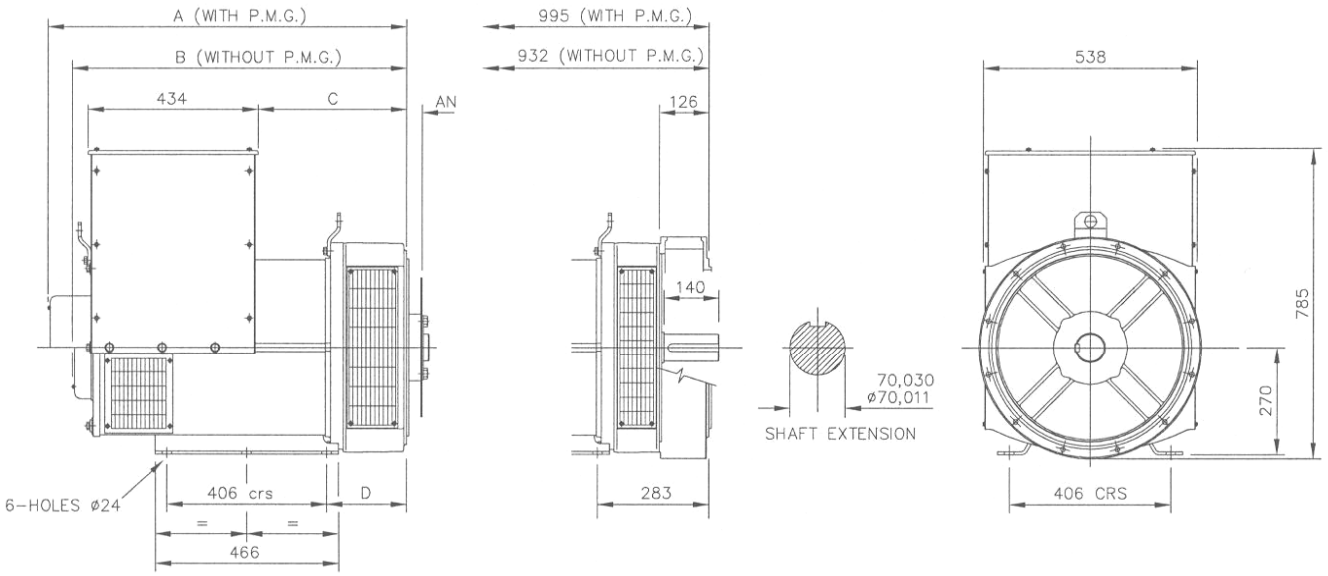
Winding 311 / 0.8 Power Factor

RATINGS

	Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	125.0	125.0	125.0	N/A	140.0	140.0	140.0	N/A	145.0	145.0	145.0	N/A	150.0	150.0	150.0	N/A
	kW	100.0	100.0	100.0	N/A	112.0	112.0	112.0	N/A	116.0	116.0	116.0	N/A	120.0	120.0	120.0	N/A
	Efficiency (%)	91.7	92.1	92.3	N/A	91.3	91.7	92.0	N/A	91.1	91.6	91.8	N/A	91.0	91.4	91.7	N/A
	kW Input	109.1	108.6	108.3	N/A	122.7	122.1	121.7	N/A	127.3	126.6	126.4	N/A	131.9	131.3	130.9	N/A
60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Series Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	140.0	143.8	143.8	160.0	160.0	167.5	167.5	178.8	170.0	175.0	175.0	187.5	175.0	181.3	181.3	193.8
	kW	112.0	115.0	115.0	128.0	128.0	134.0	134.0	143.0	136.0	140.0	140.0	150.0	140.0	145.0	145.0	155.0
	Efficiency (%)	91.9	92.2	92.5	92.5	91.4	91.7	92.1	92.1	91.2	91.5	91.9	92.0	91.0	91.4	91.8	91.9
	kW Input	121.9	124.8	124.4	138.4	140.0	146.1	145.5	155.3	149.1	153.0	152.3	163.0	153.8	158.7	158.0	168.7

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DIMENSIONS



SINGLE BEARING ADAPTORS				
ADAPTOR	A	B	C	D
SAE 1	928,3	865,3	389,3	216,3
SAE 2	914	851	375	202
SAE 3	914	851	375	202

COUPLING DISCS	
DISC	AN
SAE 10	53,98
SAE 11,5	39,68
SAE 14	25,40

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STAMFORD

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www.cumminsgeneratortechnologies.com

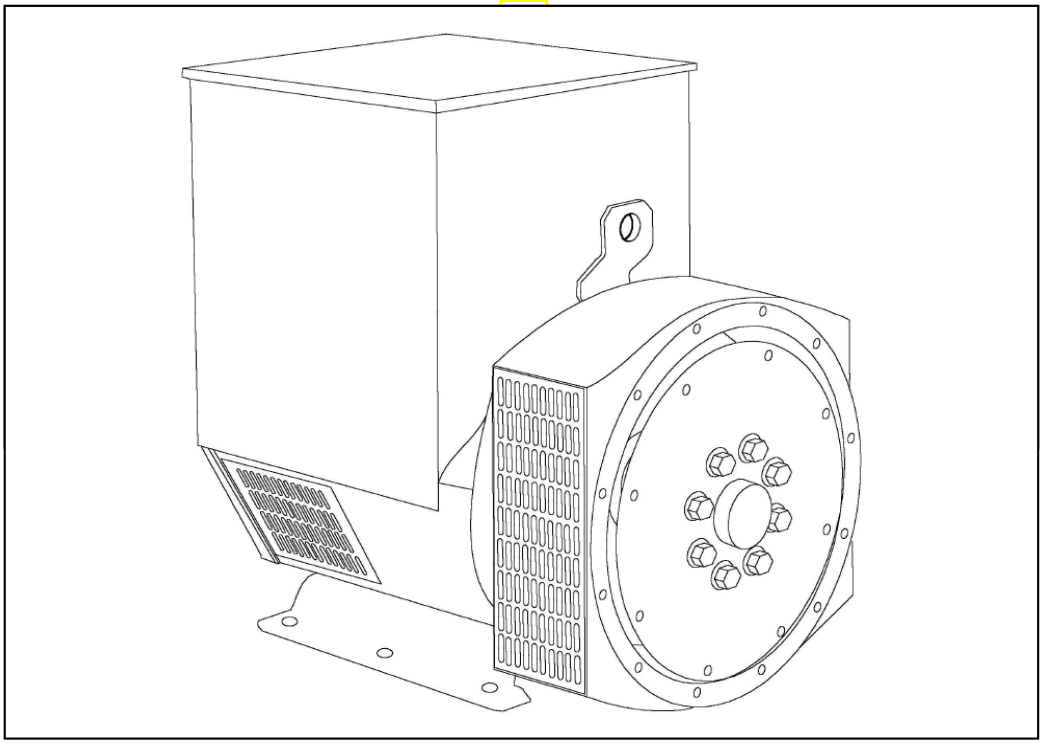
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STAMFORD®

UCI274E - Winding 17

Technical Data Sheet

AGI



SPECIFICATIONS & OPTIONS

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

SX460 AVR - STANDARD

With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

AS440 AVR

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.
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We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

APPROVED DOCUMENT

WINDINGS & ELECTRICAL PERFORMANCE

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Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

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All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation.

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The insulation system is class 'H'.
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All values tabulated on page 6 are subject to the following reductions

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3% for every 5 C by which the operational ambient temperature exceeds 40 C.
Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

UCI274E

STAMFORD

WINDING 17

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 5)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H	
PROTECTION	IP23	
RATED POWER FACTOR	0.8	
STATOR WINDING	DOUBLE LAYER CONCENTRIC	
WINDING PITCH	TWO THIRDS	
WINDING LEADS	12	
STATOR WDG. RESISTANCE	0.05 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED	
ROTOR WDG. RESISTANCE	1.34 Ohms at 22°C	
EXCITER STATOR RESISTANCE	20 Ohms at 22°C	
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C	
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others	
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%	
MAXIMUM OVERSPEED	2250 Rev/Min	
BEARING DRIVE END	BALL. 6315-2RS (ISO)	
BEARING NON-DRIVE END	BALL. 6310-2RS (ISO)	
	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	492 kg	511 kg
WEIGHT WOUND STATOR	180 kg	180 kg
WEIGHT WOUND ROTOR	167.51 kg	156.55 kg
WR² INERTIA	1.3271 kgm^2	1.2765 kgm^2
SHIPPING WEIGHTS in a crate	525 kg	539 kg
PACKING CRATE SIZE	123 x 67 x 103(cm)	123 x 67 x 103(cm)
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	0.617 m^3/sec 1308 cfm	
VOLTAGE SERIES STAR	600V	
VOLTAGE PARALLEL STAR	300V	
VOLTAGE SERIES DELTA	346V	
kVA BASE RATING FOR REACTANCE VALUES	178.8	
Xd DIR. AXIS SYNCHRONOUS	2.06	
X'd DIR. AXIS TRANSIENT	0.18	
X"d DIR. AXIS SUBTRANSIENT	0.13	
Xq QUAD. AXIS REACTANCE	1.34	
X"q QUAD. AXIS SUBTRANSIENT	0.17	
X_L LEAKAGE REACTANCE	0.07	
X_2 NEGATIVE SEQUENCE	0.14	
X_0 ZERO SEQUENCE	0.09	
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.	0.032s	
T"d SUB-TRANSTIME CONST.	0.01s	
T'do O.C. FIELD TIME CONST.	0.85s	
Ta ARMATURE TIME CONST.	0.007s	
SHORT CIRCUIT RATIO	1/Xd	

APPROVED DOCUMENT

UCI274E

Winding 17

SX

Locked Rotor Motor Starting Curves

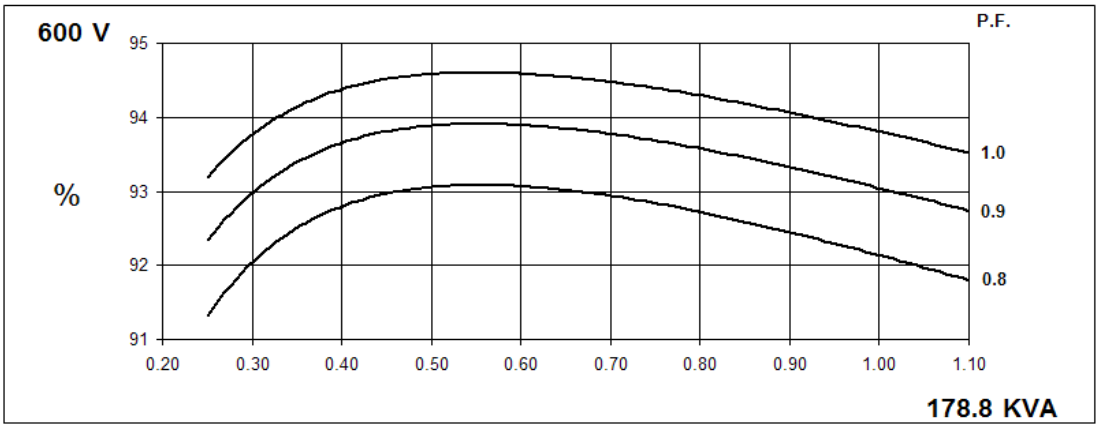


MX



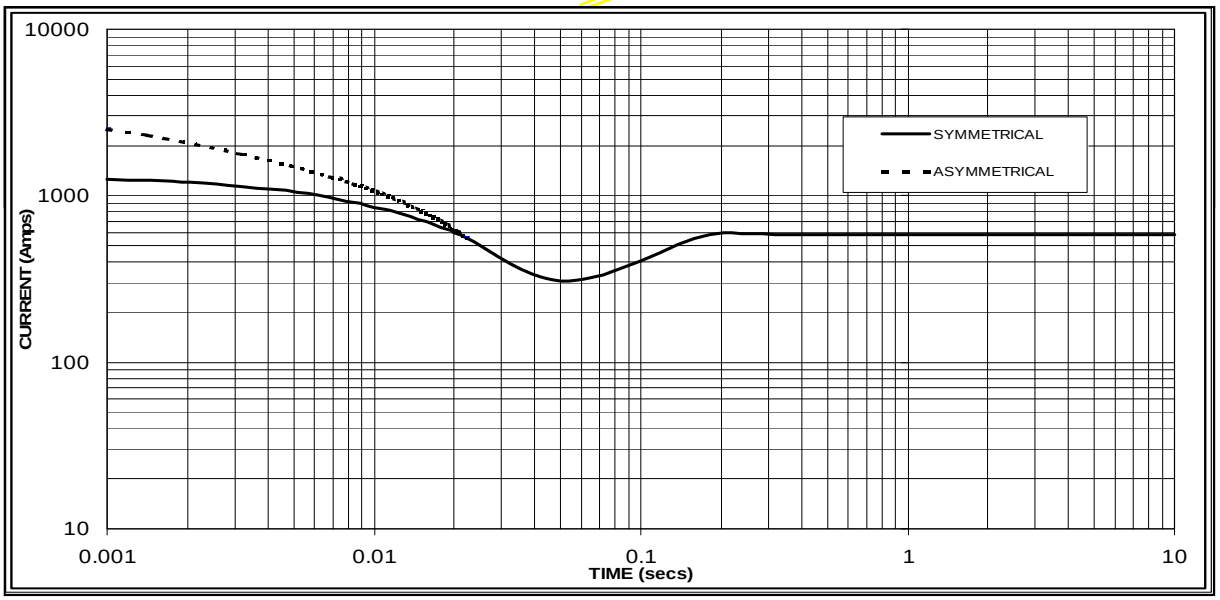
STAMFORD

THREE PHASE EFFICIENCY CURVES



Proto

Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.



Sustained Short Circuit = 580 Amps

Note
The following multiplication factor should be used to convert the values from curve for the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

UCI274E

Winding 17 / 0.8 Power Factor

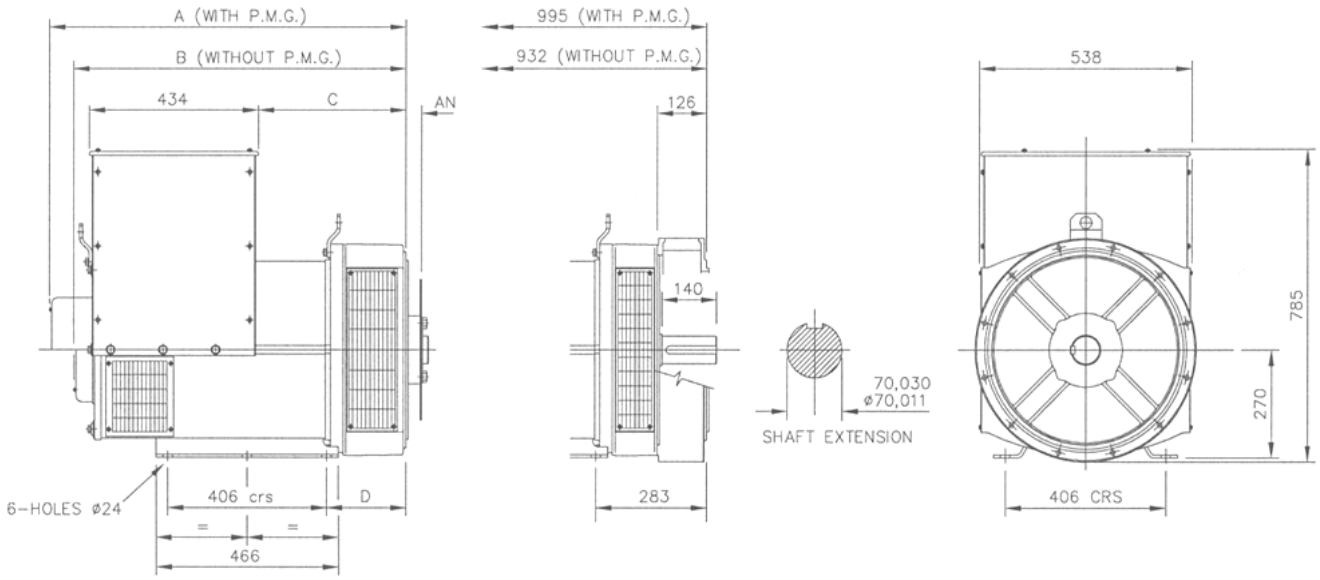
60Hz

RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Series Star (V)	600	600	600	600
Parallel Star (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	160.0	178.8	187.5	193.8
kW	128.0	143.0	150.0	155.0
Efficiency (%)	92.5	92.1	92.0	91.9
kW Input	138.4	155.2	163.1	168.8

APPROVED

DIMENSIONS



SINGLE BEARING ADAPTORS				
ADAPTOR	A	B	C	D
SAE 1	928,3	865,3	389,3	216,3
SAE 2	914	851	375	202
SAE 3	914	851	375	202

COUPLING DISCS	
DISC	AN
SAE 10	53,98
SAE 11,5	39,68
SAE 14	25,40

APPROVED DOCUMENT

STAMFORD

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DGC-2020 Digital Genset Controller







A highly advanced integrated genset control system, this device provides genset control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.

Features

- Generator metering (includes three-phase mains)
- Engine and generator protection: 27, 32R, 40Q, 59, 81O/U
- Optional enhanced generator protection: 47, 51, 78, and 81ROCOF
- Load sharing and generator sequencing (via LSM-2020 Load Share Module)
- Var sharing over Ethernet (via LSM-2020)
- BESTCOMS*Plus*® Software
  - Programming and setup
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable logic
  - USB communications
- Automatic transfer switch control
- Automatic synchronizer (optional)
- Exercise timer
- SAE J1939 engine ECU communications
- Automatic generator configuration detection
- Expandable functionality via add-on modules
  - LSM-2020 Load Share Module
  - CEM-2020 Contact Expansion Module
  - AEM-2020 Analog Expansion Module
- Multilingual capability
- Remote communications to Basler's RDP-110 (remote display panel)
- Sixteen programmable contact inputs
- Up to 15 contact outputs: 3 contacts rated for 30 Adc and up to 12 programmable contacts rated for 2 Adc

Visit www.basler.com for additional information.

Benefits

- Provides integrated engine-genset control, protection, and metering in a single package.
- The Offline Simulator, provided in BESTlogic™*Plus*, helps test and troubleshoot logic without the need for expensive hardware.
- Flexible programmable logic and programmable I/O make it easy to expand the DGC-2020's inputs and outputs with the CEM-2020 (Contact Expansion Module) and the AEM-2020 (Analog Expansion Module). This saves time and money by eliminating unnecessary external PLCs and control relaying.

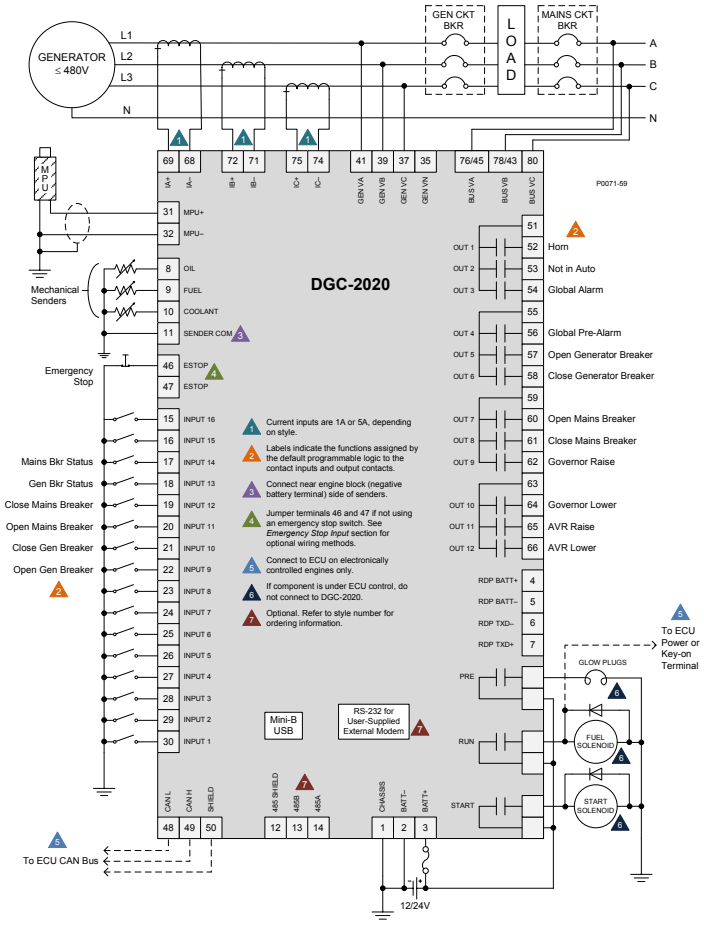


Figure 1 - DGC-2020 Connection Diagram for a Typical Application

Specifications

Power Supply

Nominal:	12 or 24 Vdc
Range:	6 to 32 Vdc
Battery Ride Through:	Starting at 10 Vdc, withstands cranking ride-through down to 0 V for 50 ms

Power Consumption

Sleep Mode:	5 W
Normal Operational Mode:	7.9 W
Maximum:	14.2 W

Current Sensing

1 A Sensing:	0.02 to 1.0 Aac, continuous 2 Aac for 1 second
5 A Sensing:	0.1 to 5.0 Aac, continuous 10 Aac for 1 second
Burden:	1 VA

Voltage Sensing

Range:	12 to 576 Vrms L-L
Frequency Range:	10 to 72 Hz for 50/60 Hz style, 10 to 480 Hz for 400 Hz style
Burden:	1 VA
One-second Rating:	720 Vrms

Contact Sensing

Contact Inputs (16):	Accepts normally open (N.O.), Dry Contacts, programmable
Emergency Stop:	Normally closed (N.C.), Dry Contact

Engine Speed Sensing

Magnetic Pickup:	
Voltage Range:	6 to 70 Vpp
Frequency Range:	32 to 10,000 Hz
Generator Frequency:	
Generator Voltage Range:	12 to 576 Vrms
Via ECU over J1939	

Resistive Senders

Fuel Level Sender:	0 to 250 Ω nominal
Coolant Temp Sender:	10 to 2,750 Ω nominal
Oil Pressure Sender:	0 to 250 Ω nominal

Output Contacts

Fuel Solenoid, Engine Crank, Pre-Start Relays Rating:	30 Adc at 28 Vdc-make, break, and carry
Programmable Relays:	Up to 12
Rating:	2 Adc at 28 Vdc-make, break, and carry

Protection

Generator:	27, 32R, 40Q, 59, 81O/U (standard) 47, 51, 78, 81 ROCOF (optional)
Engine:	Oil pressure, coolant temperature, overcrank, ECU-specific elements, and diagnostic reporting.

Agency Approvals

CSA certified, NFPA compliant, CE compliant, UL recognized (Hazardous Location certification available upon request), EAC certified

Communication

USB Port:	USB 2.0, Mini-B jack
RS-485 (optional):	9600 baud, 8 data bits, no parity
RDP-110 (optional):	4,000 ft (1,219 m) max wire length, 20 AWG (0.52 mm²) min wire size
Modem (optional):	DB-9 connector (male)
CAN bus:	250 kb/s communication rate, 1.5 to 3 Vdc differential bus

Environmental

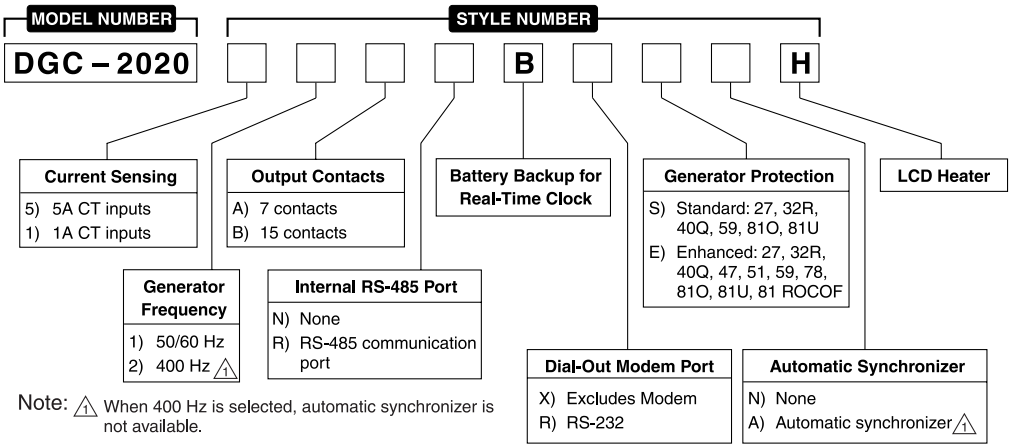
Operating Temp:	-40°C to 70°C (-40°F to 158°F)
Storage Temp:	-40°C to 85°C (-40°F to 185°F)
Humidity:	IEC 68-2-38
Salt Fog:	ASTM B 17-73, IEC 68-2-11
Ingress Protection:	IEC IP54 for front panel
Shock:	15 G in three perpendicular planes
Vibration:	
5 to 29 Hz:	1.5 G peak
29 to 52 Hz:	0.036″ (0.914 mm) double amplitude
52 to 500 Hz:	5 G peak

Physical

Weight:	4.4 lb (2 kg)
Dimensions (WxHxD):	11.77 x 8.27 x 2.69 inches (299 x 210 x 69 mm)

For complete specifications, download the instruction manual at www.basler.com.

Style Chart



Note: 1 When 400 Hz is selected, automatic synchronizer is not available.

Related Products

- BE1-11*g* Generator Protection System
  - A complete generator protection system.
- DECS-250 Digital Excitation Control System
  - Total control in a compact package provides precise voltage, var and power factor regulation, exceptional system response, and generator protection.

Accessories

- AEM-2020 Analog Expansion Module
  - Easily increases the functionality by seamlessly adding analog inputs and outputs.
- CEM-2020, CEM-2020H Contact Expansion Module
  - Each module adds 10 inputs and up to 24 outputs that are easily programmed through BESTCOMS*Plus*® for easy integration into the system.
- LSM-2020 Load Share Module
  - The simple-to-use LSM-2020 easily adds paralleling capabilities with little effort and expense.
- RDP-110 Remote Display Panel
  - Provides remote alarm and pre-alarm indication and annunciation of system status, easily meeting the annunciation requirements of NFPA-110 applications.

ISO 9001-2008
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e-mail: singaporeinfo@basler.com

Tmax-Molded Case Circuit Breakers

T3 225A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories



Dimensions 3P Fixed Version 5.9H x 4.13W x 2.76D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T3	
Continuous Current Rating		225A	
Number of Poles		3-4	
		N	**S**
AC			
240V		50	65
480V		25	35
600Y / 347V		10	10
DC			
250V	2 poles in series	25	35
500V	3 poles in series	25	35

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Plug-in

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMF thermo magnetic trip units, with fixed thermal and magnetic threshold (I3 = 10 x In);

Weight (lbs)	5.45

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Solenoid operator
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

Publication LV037
No. 1SXU 210 037 D0201
Printed in USA, November, 2005

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T4 250A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 8.07H x 4.13W x 4.07D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T4				
Continuous Current Rating		250A				
Number of Poles		3-4				
		N	**S**	**H**	**L**	**V**
AC						
240V		65	100	150	200	200
480V		25	35	65	100	150
600V		18	25	35	65	100
DC*						
500V	2 poles in series	25	35	50	65	100
600V	3 poles in series	16	25	35	50	65

*Thermo Magnetic Trip Only

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Mounting

Fixed
Plug-in
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMF thermo magnetic trip units, with fixed thermal and magnetic threshold (I3 = 10 x In);

TMD (up to 50 A) thermo magnetic trip units with adjustable thermal threshold (I1 = 0.7…1 x In) and fixed magnetic threshold (I3 = 10 x In).

TMA thermo magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit

Weight (lbs)	6.18

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

Publication LV038
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Printed in USA, November, 2005

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T5 400A and 600A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches (400A Only)

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 8.07H x 5.51W x 4.07D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T5				
Continuous Current Rating		400-600A				
Number of Poles		3-4				
		N	**S**	**H**	**L**	**V**
AC						
240V		65	100	150	200	200
480V		25	35	65	100	150
600V		18	25	35	65	100
DC* (400 A only)						
500V	2 poles in series	25	35	50	65	100
600V	3 poles in series	16	25	35	50	65

*Thermo Magnetic Trip Only

Company Quality Systems and Environmental Systems

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Mounting

Fixed
Plug-in
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermo magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit

Weight (lbs)	8.55

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

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ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Digital Linear Chargers

Specifications

- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant
- UL listed to marine standard 1236
- 3 year warranty
- Replaces all existing current on-board chargers (excluding portables)
- No Price Increase
- Availability: November 2010



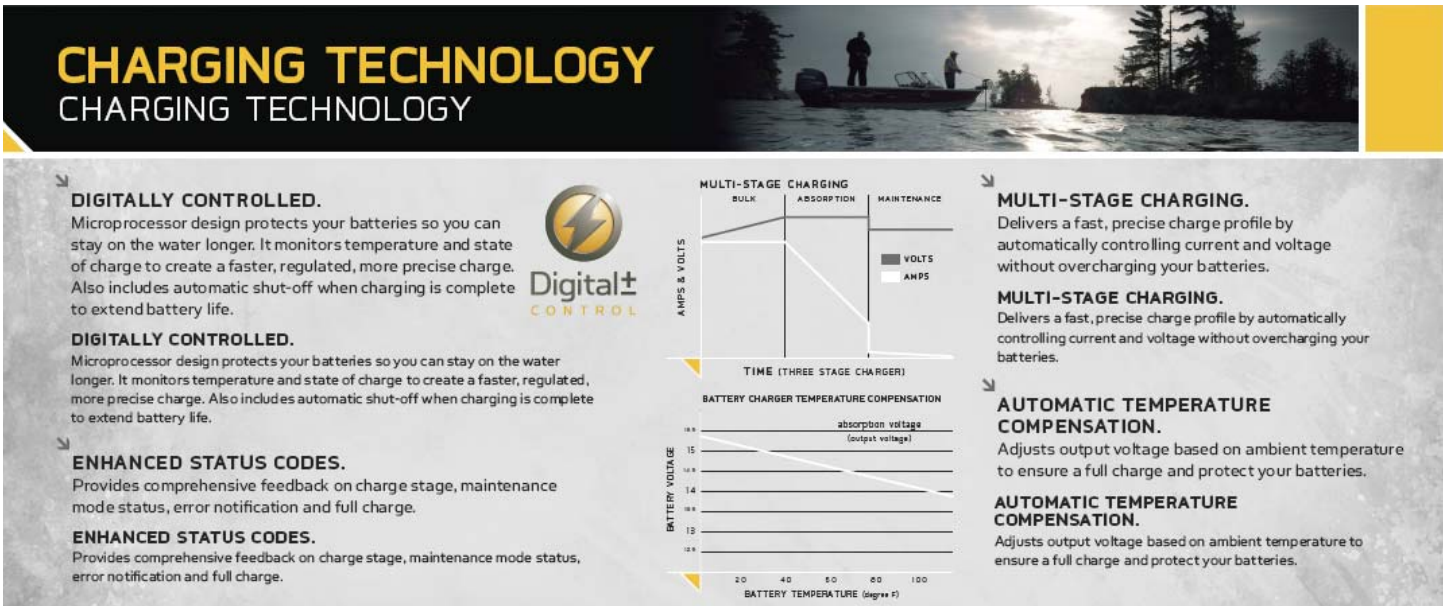
DIGITAL LINEAR ON-BOARD CHARGERS	
PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 amps)
1822305	MK-230D (2 bank x 15 amps)
1823455	MK-345D (3 bank x 15 amps)
1824605	MK-460D (4 bank x 15 amps)

Digital Linear Chargers

Specifications (cont.)

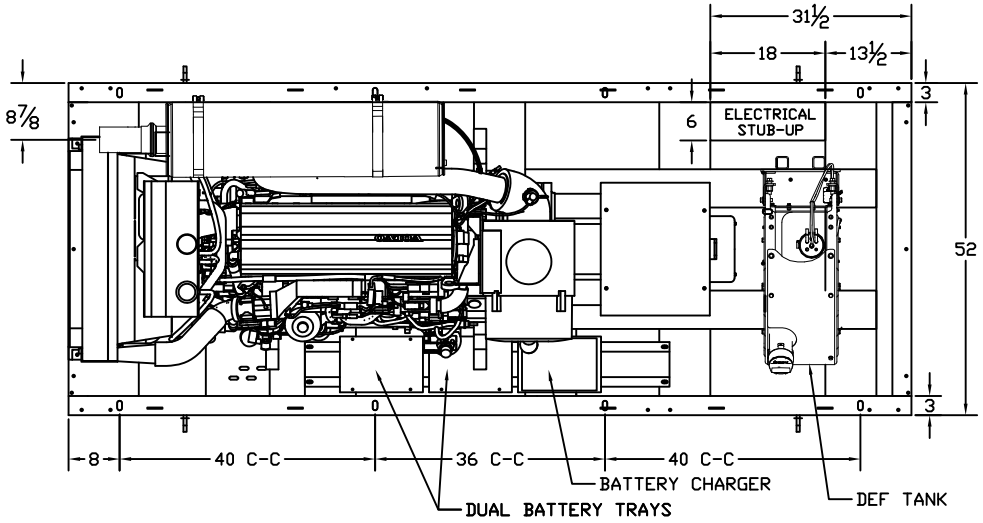
- New 4-color package design

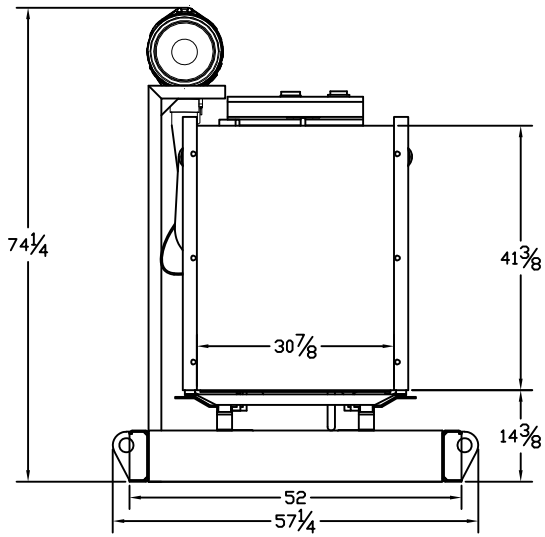




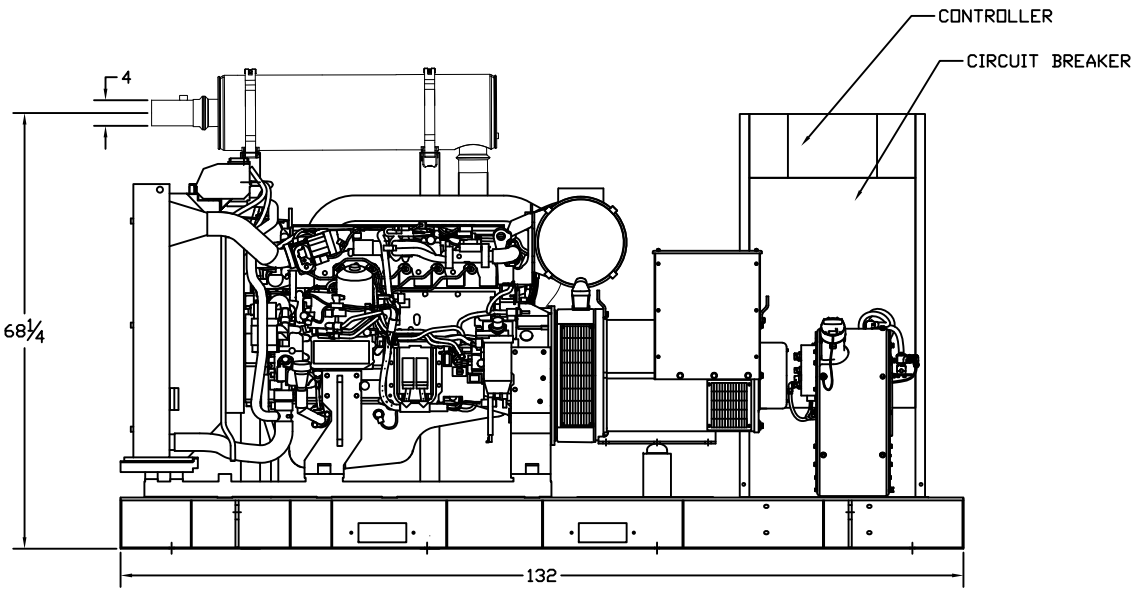
OUTLINE DIMENSIONS FOR T4D-1000 OPEN

TOP VIEW





RADIATOR END VIEW

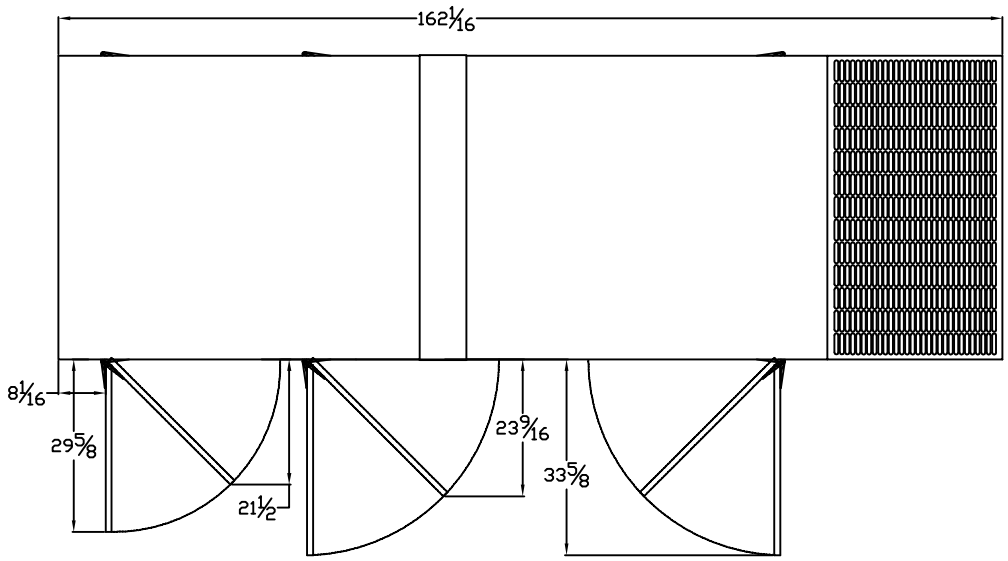


RIGHT SIDE VIEW

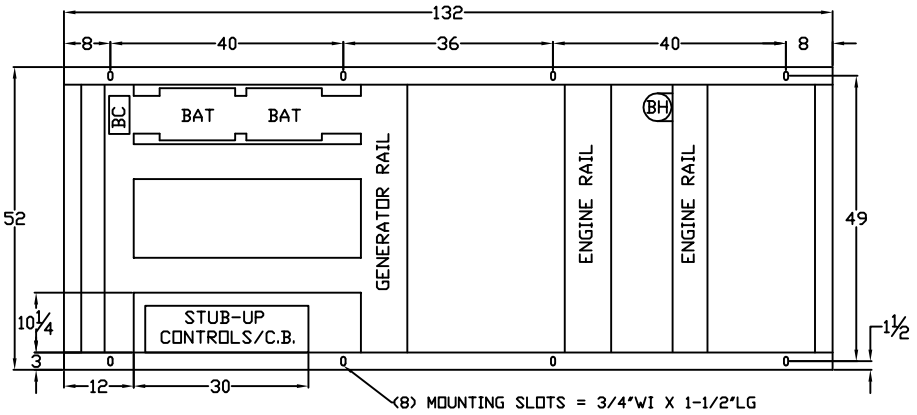
OUTLINE DIMENSIONS FOR T4D 100 - 200 KW LEVEL 2 ENCLOSURE
(HINGED DOORS)

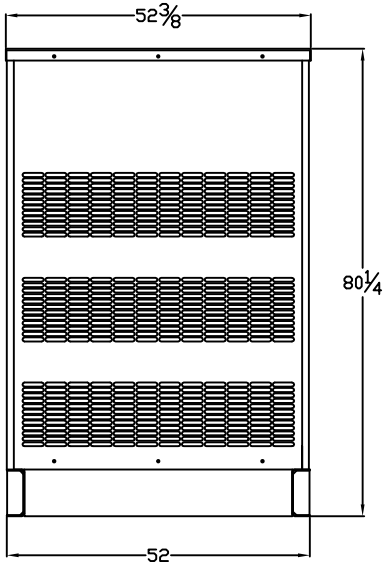
TOP VIEW

(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)

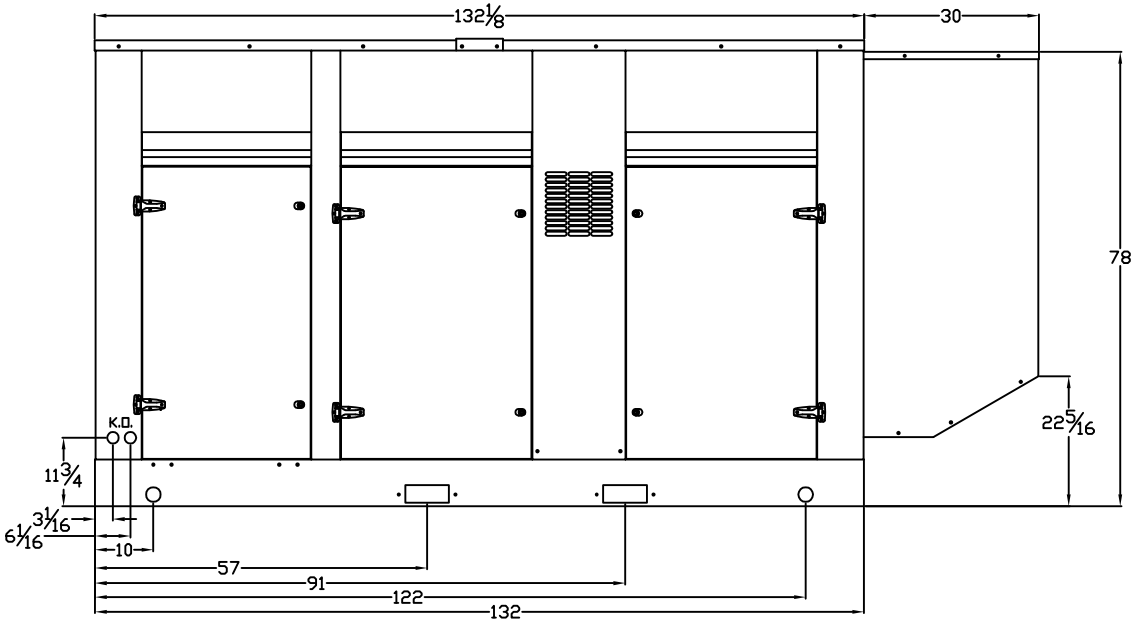


FRAME VIEW

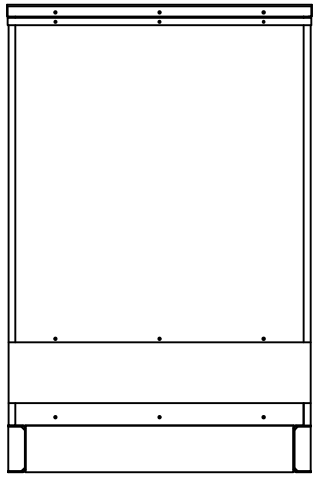




GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW

GILLETTE GENERATORS

LIQUID COOLED DIESEL ENGINE GENERATOR SET

60 HZ MODEL

T4D-1500

Model	HZ	STANDBY 130ºC RISE	PRIME 105ºC RISE
T4D-1500-60 HERTZ	60	150	150

All generator sets are USA prototype built and thoroughly tested. Production models are USA factory built and 100% load tested.

UL1446, UL508, UL142, UL498

NFPA 110, 99, 70, 37
All generator sets meet NFPA-110 Level 1, when equipped with the necessary accessories and installed per NFPA standards.

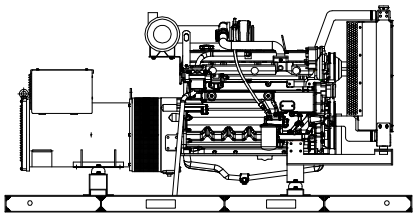
NEC 700, 701, 702, 708

NEMA ICS10, MG1, ICS6, AB1

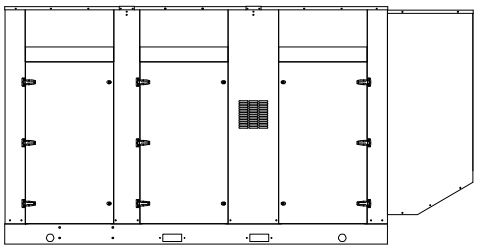
ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05

ASCE 7-05 & 7-10
All generator sets meet 180 MPH rating.

EPA 40CFR Part 60, 89, 1039, 1048, 1054, 1065, 1068



"OPEN" GEN-SET
There is no enclosure, so gen-set must be placed within a weather protected area, un-inhabited by humans or animals, with proper ventilation. Silencer not supplied, as installation requirements are not known. However, this item is available as optional equipment.



"LEVEL 2" HOUSED GEN-SET
Full aluminum weather protection and superior sound attenuation for specific low noise applications. Critical grade muffler is standard.

GENERATOR RATINGS

GENERATOR MODEL	VOLTAGE		PH	HZ	130ºC RISE STANDBY RATING		105ºC RISE PRIME RATING	
	L-N	L-L			KW/KVA	AMP	KW/KVA	AMP
T4D-1500-1-1	120	240	1	60	150/150	625	150/150	625
T4D-1500-3-2	120	208	3	60	150/187	521	150/187	521
T4D-1500-3-3	120	240	3	60	150/187	451	150/187	451
T4D-1500-3-4	277	480	3	60	150/187	225	150/187	225
T4D-1500-3-16	346	600	3	60	150/187	180	150/187	180

RATINGS: All three phase gen-sets are 12 lead windings, rated at .8 power factor. 130° C "STANDBY RATINGS" are strictly for gen-sets that are used for back-up emergency power to a failed normal utility power source. This standby rating allows varying loads, with no overload capability, for the entire duration of utility power outage. 105° C "PRIME RATINGS" are strictly for gen-sets that provide the prime source of electric power, where normal utility power is unavailable or unreliable. A 10% overload is allowed for a total of 1 hour, within every 12 hours of operation, on every PRIME RATED systems. All gen-set power ratings are based on temperature rise measured by resistance method as defined by MIL-STD 705C and IEEE STD 115, METHOD 6.4.4. All generators have class H (180°C) insulation system on both rotor and stator windings. All factory tests and KW/KVA charts shown above are based 130°C (standby), and 105°C (prime) R/R winding temperature, within a maximum 40°C ambient condition. Generators operated at standby power ratings must not exceed the temperature rise limitation for class H insulation system, as specified in NEMA MG1-22.40. Specifications & ratings are subject to change without prior notice.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-1500-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer ..... Stamford Generators
Model & Type ..... UCDI274K-311, 4 Pole, 4 Lead, Single Phase
..... UCI274G-311, 4 Pole, 12 Lead, Three Phase
..... UCI274G-17, 4 Pole, 12 Lead, 600V, Three Phase
Exciter ..... Brushless, shunt excited
Voltage Regulator ..... Solid State, HZ/Volts
Voltage Regulation ..... ½%, No load to full load
Frequency ..... 60 HZ
Frequency Regulation ..... ± ½% (1/2 cycle, no load to full load)
Unbalanced Load Capability ..... 100% of standby amps
One Step Load Acceptance ..... 100% of nameplate rating
Total Stator and Load Insulation ..... Class H, 180°C
Temperature Rise ..... 105°C R/R, prime rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V) ... 1500 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V-600V) 2300 kVA
Bearing ..... 1, Pre-lubed and sealed
Coupling ..... Direct flexible disc.
Total Harmonic Distortion ..... Max 3½% (MIL-STD705B)
Telephone Interference Factor ..... Max 50 (NEMA MG1-22)
Deviation Factor ..... Max 5% (MIL-STD 405B)
Alternator ..... Self ventilating and drip-proof
Ltd. Warranty Period ..... 24 Months from start-up date or
..... 1000 hours use, first to occur.

GENERATOR FEATURES

- World Renown Stamford Electric Generator having UL-1446 certification.
- Full generator protection with **Basler DGC-2020** controller, having UL-508 certification.
- Automatic voltage regulator with over-excitation, under-frequency compensation, under-speed protection, and EMI filtering. Entire solid-state board is encapsulated for moisture protection.
- Generator power ratings are based on temperature rise, measured by resistance method, as defined in MIL-STD 705C and IEEE STD 115, Method 6.4.4.
- Power ratings will not exceed temperature rise limitation for class H insulation as per NEMA MG1-22.40.
- Insulation resistance to ground, exceeds 1.5 meg-ohm.
- Stator receives 2000 V. hi-potential test on main windings, and rotor windings receive a 1500 V. hi-potential test, as per MIL-STD 705B.
- Full amortisseur windings with UL-1446 certification.
- Complete engine-generator torsional acceptance, confirmed during initial prototype testing.
- Full load testing on all engine-generator sets, before shipping.

ENGINE SPECIFICATIONS AND APPLICATIONS DATA

ENGINE

Manufacturer ..... VOLVO-PENTA
Model and Type ..... TAD871VE, 4 cycle, liquid Cooled
Aspiration ..... Turbo After Cooler, Air to Air
Charged Air Cooled System ..... Air to Air
Cylinder Arrangement ..... 6 Cylinders, In-Line
Displacement Cu. In. (Liters) 470 (7.70)
Bore & Stroke in (Cm) ..... 4.33 x 5.31 (11.0 x 13.5)
Compression Ratio 17.5:1
Main Bearings ..... Tin Overlay with Babbit Backing
Cylinder Head ..... Cast Iron with overhead Cam
Pistons ..... Aluminum Alloy with Graphite Coating
Crankshaft ..... Induction Hardened, Heat Treated Forged
Valves ..... Heat Treated and Hardened Exhaust Valve
Governor ..... Electronic, EMS 2.2
Frequency Regulation ..... ± 1/4%
Air Cleaner ..... Dry, Replaceable Cartridge
Engine Speed ..... 1800 rpm
Max Power, bhp (kwm) Standby 252 (185)
BMEP: psi (MPa) Standby 331 (2.3)
Ltd. Warranty Period ..... 2 Year or 1000 hrs, first to occur

FUEL SYSTEM

Type ..... Diesel Fuel Oil (ASTM No. 2-D)
Combustion System ..... Direct Injection
Fuel Injection Pump ..... Electronic, Delphi E3
24 VDC Coolant heaters ..... Optional Equipment
Fuel Filter .... Yes with Water Separator

FUEL CONSUMPTION

GAL/HR (LITER/HR)	STANDBY	PRIME
100% LOAD	11.5 (43.5)	11.5 (43.5)
75% LOAD	9.62 (36.5)	9.62 (36.5)
50% LOAD	6.81 (25.8)	6.81 (25.8)
DEF Consumption is 6% of fuel consumption		

OIL SYSTEM

Type ..... Full Pressure
Oil Pan Cap. W/ filter qt. (L) 28.5 (27)
Oil Filter ..... 3, Replaceable Cartridge type

ELECTRICAL SYSTEM

Ignition System ..... Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 110 amp/hr.

Recommended battery to -18°C (0° F): ....(2) 12 VDC, BCI# 31, Max. Dimensions: 14"lg x 6 3/4" wi x 10" hi, with standard round posts. Min output 1000 CCA. Battery tray (max. dim. at 15"lg x 7"wi). This model has (2) battery trays, (2) hold down straps, (2) sets of battery cables, and (1) battery charger. Installation of (2) 12VDC starting batteries connected in series for 24VDC output is required, with possible higher AMP/HR rating, as described above, if the normal environment temperature averages -13° F (-25°C) or cooler.

CERTIFICATIONS

All engines are EPA emissions certified. All non-emergency stationary diesel engines are Tier IV Final compliant.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-1500-60 HZ

COOLING SYSTEM

Type of System ..... Air to Air, Charged Air Cooler
Coolant Pump .....Pre-lubricated, self-sealing
Cooling Fan Type .....Pusher
Fan Diameter inches (cm).....35.1 (89)
Fan drive ratio..... 1.04:1
Ambient Capacity of Radiator °F (°C).....131 (55)
Engine Jacket Coolant Capacity gal. (L).....8.70 (33)
Radiator Coolant Capacity gal. (L) 16.0 (60)
Water Pump Capacity gpm (L/min)..... .....122 (462)
Heat Reject Coolant: Btu/min ....….12,682
Air to Air Heat Reject, BTU/min. ....….11,715
Heat Radiated to Ambient, BTU/min .... ….4,253
Low Radiator Coolant Level Shutdown……..Standard
Note: Coolant temp. shut-down switch setting at 228°F (109°C) with 50/50 (water/antifreeze) mix.

COOLING AIR REQUIREMENTS

Combustion Air cfm (m^3/min) 1,646 (46.6)
Max Air Intake Restrictions:
Clean Air Cleaner, KPA (psi) 5 (1.5)
Radiator Cooling Air, SCFM (m^3/min)……....29,894 (846)

EXHAUST SYSTEM

Exhaust Outlet Size.....5"
Max. Back Pressure in KPA (in. H2O).....8 (32)
Exhaust Flow, at rated KW, CFM (m3/min)..... 886 (25.1)
Exhaust Temp, (Stack) °F (ºC) 709 (376)

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, SCR/Residential Silencer	83	79

Note: Open sets (no enclosure) have installed selective catalytic reduction/residential silencer system. Level 2 enclosure has installed selective catalytic reduction/residential silencer. Sound tests are averaged from several test points and taken at 23 ft. (7 m) from source of noise at normal operation.

DERATE GENERATOR FOR ALTITUDE

3% per 1000 ft. (305m) above 3000 ft. (914m) from sea level

DERATE GENERATOR FOR TEMPERATURE

2% per 10°F (5.6°C) above 104°F (40°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm)	132 (335)	162 (412)
Width in (cm)	52 (132)	52 (132)
Height in (cm)	65 (165)	80 (203)
Net Weight lbs (kg)	4362 (1979)	5632 (2555)
Ship Weight lbs (kg)	4637 (2104)	5907 (2680)

BASLER DGC-2020 DIGITAL MICROPROCESSOR CONTROLLER



Basler DGC-2020

The "**2020**" controller is a highly advanced integrated gen-set control system for single gen-set applications. This controller includes a backlit LCD display which continuously displays the status of the engine and generator at all times.

Basler "**DGC-2020"** includes: Generator metering (including three phase) • Engine – Generator protections including IEEE-[27] under voltage, [32] power, [40] loss of excitation, [59] over voltage, [81] over and under frequency, Exercise timer • SAE J1939 engine ECU communications • Expansion capabilities for both inputs and outputs with expansion • Remote communications through RS-485 to Basler's RDP110 remote Display panel • (16) programmable contact inputs • (15) programmable contact outputs- (3) for up to 30AmpDC and (12) for up to 2 Amp DC • Illuminated Text Display • Front panel menu scroll buttons • Front panel operation mode buttons for STOP, RUN and AUTO • Alarm Silence and Lamp Test buttons

This controller includes expansion features including, RS485 (using MODBUS), direct USB connection with PC, expansion optioned using BESTCOMSPlus for remote annunciation and remote relay interfacing for a distance of up to 3300FT. The controller software is freely downloadable from the internet and allows monitoring with direct USB cable, LAN, or by internet via the built in web interface.



Further expansion is available by adding the optional RDP-110 remote display panel module. This featured device will allow Four programmable LEDs (2) alarms and (2) pre-alarms • (17) alarms and pre-alarms displayed from Basler controller • audible alarm horn • lamp test and alarm silence buttons • RD100 local power supply inputs of either 12vdc or 24vdc • connects through Basler controller through RS-485 communications protocol • conduit box included for (2) mounting configurations- either surface mount or semi-flush mounting.

STANDARD FEATURES FOR MODEL T4D-1500-60 HZ

STANDARD FEATURES

CONTROL PANEL:

Basler DGC-2020 digital microprocessor with logic allows programming in the field. Controller has:

- STOP-MANUAL-AUTO modes and automatic engine shutdowns, signaled by full text LCD indicators:
- Low oil pressure
- High engine temp
- Low Radiator Level
- Three auxiliary alarms
- Battery fail alarm
- Engine fail to start
- Engine over speed
- Engine under speed
- Over & under voltage

Also included is tamper-proof engine hour meter

ENGINE:

Fuel filter • Full flow Oil filter • Air filter • Fuel pump • Oil pump • Solenoid type starter motor • Hi-temp radiator • Jacket water pump • Thermostat • Pusher fan and guard • Exhaust manifold • Electronic Governor • 24 VDC battery charging alternator • Flexible fuel and exhaust connectors • Vibration isolators • Open coolant recovery system with 50/50 water to anti-freeze mixture • flexible oil & radiator hose • Shut-down sensors for low oil pressure, high coolant temp., low coolant level, high ambient temp.

Design & specifications subject to change without prior notice. Dimensions shown are approximate. Contact Gillette for certified drawings. DO NOT USE DIMENSIONS FOR INSTALLATION PURPOSES.

AC GENERATOR SYSTEM:

AC generator • Shunt excited • Brushless design • Circuit Breaker installed and wired to gen-set • Direct connection to engine with flex disc • Class H, 180°C insulation • Self ventilated • Drip proof construction • UL Certified

VOLTAGE REGULATOR:

1% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

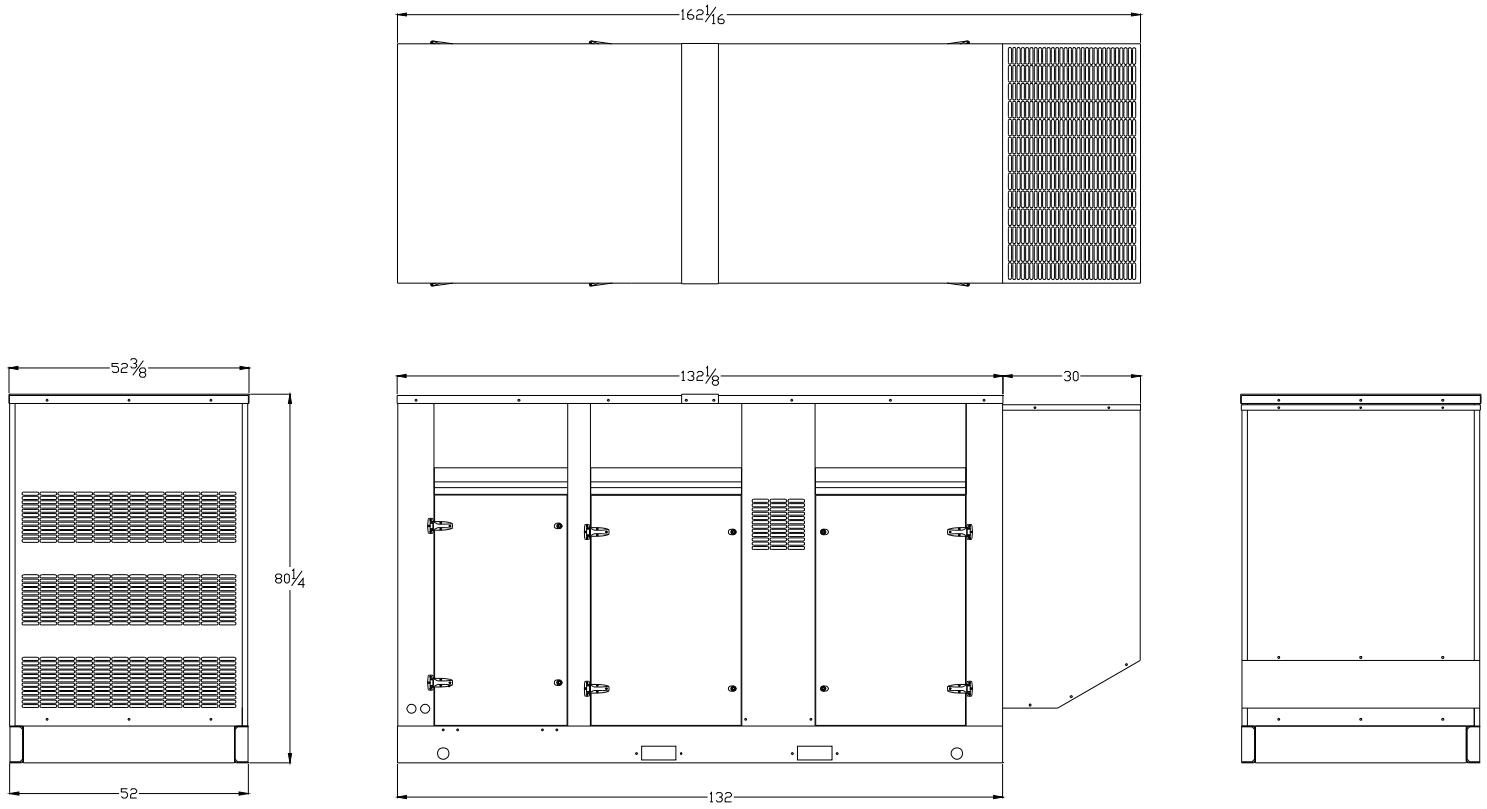
DC ELECTRICAL SYSTEM:

Battery trays • Battery cables • Battery hold down straps • 3-stage battery charger with float, absorption, & bulk automatic charge stages

WEATHER / SOUNDPROOF ALUMINUM HOUSING:

Corrosion Resistant Protection consisting of:

- (9) Heated and Agitated Wash Stages
- Zinc Phosphate Etching-Coating Stage
- Final Baked on Enamel Powder Coat
- 18/8 Stainless Steel Hardware



Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with ⚠ are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalities as described in the Clean Air Act.

General

In-line four stroke diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel

Number of cylinders			6
Displacement, total		liters in^3	7,70 470
Firing order			1-4-2-6-3-5
Bore		mm in	110 4,33
Stroke		mm in	135 5,31
Compression ratio			17.5:1
Wet weight (Not including after treatment system)	Engine only	kg lb	737 1625
	Power pac	kg lb	947 2088

Performance				**rpm**	**1500**	**1800**	**2000**	**2200**
ICFN Power 185 kW		without fan		kW hp	181 246	185 252	185 252	185 252
		with fan 650 mm pull		kW hp	172 234	169 230	166 225	161 219
Torque at:		ICFN Power 185 kW		Nm lbf ft	1150 848	982 724	884 652	803 592
Max torque at engine speed	ICFN Power		1200 rpm	Nm lbf ft	1160 856			
Power tolerance				%	±3			
Mean piston speed				m/s ft/sec	6,8 22,1	8,1 26,6	9,0 29,5	9,9 32,5
Effective mean pressure at:		ICFN Power 185 kW		MPa psi	1,88 273	1,60 232	1,44 209	1,31 190
Total mass moment of inertia, J (mR^2) (not including flywheel)				kgm^2 $lbft^2$	0,398 9,4			
Friction Power				kW hp	17 23	23 31	29 39	35 48
Derating see Technical Diagrams								

Engine brake performance (only engines with engine brake)		rpm	1500	2200	2500	2800
Brake power:	without fan	kW	70	121	145	170
		hp	95	165	197	231
Brake torque:	without fan	Nm	448	524	555	580
		lbf ft	330	386	409	428
Engine speed range for engine brake activation:		rpm	900-2800			
Min engine speed with engine brake still active:		rpm	900			
Min oil temperature for engine brake activation:		°C	55			

Cold start performance

*Cold start limit temperature	without starting aid	°C °F	-15 5	
	with manifold heater 4 kW	°C °F	-30 -22	
	with manifold heater 4 kW and block heater	°C °F	-35 -31	
*Specify oil quality	Above -15°C; 15W40 Above -25°C; 10W30 Below -25°C; 5W30			
Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
	Volvo	1,5		

* See also general section in the sales guide

Lubrication system

Lubricating oil consumption (average)			Vol%	0,05
Oil system capacity including filters			liter US gal	27 7,13
Oil pan capacity:		Max	liter US gal	24 6,34
		Min	liter US gal	19 5,02
Oil change intervals/specifications	VDS4		h	500
			h	
Engine angularity limits:	front up		°	40
	front down		°	45
	side tilt		°	40
Oil pressure at rated power			kPa psi	425 62

Lubrication system

Lubrication oil temperature in sump:	max	°C °F	125 257
Oil filtration efficiency (in accordance with ISO 4548-12)	97%	µ	36
	50%	µ	14

Fuel system		rpm	1500	1800	2000	2200
Urea consumption (vol% of diesel consumption)		vol%	7%			
Fuel to conform to			EU EN590 US D975, 1-D and 2-D (Max 15ppm sulphur and 7% FAME)			
System supply flow at max. speed		liter/h US gal/h	122 32,2			
Fuel supply line max. restriction (Measured at fuel inlet connection)		kPa psi	25 3,6			
Fuel supply line max. pressure, during engine stand still (meassured at fuel inlet connection)		kPa psi	20 2,9			
System return flow at max. speed		liter/h US gal/h	60,0 15,9			
Fuel return line max. restriction (Measured at fuel return connection)		kPa psi	15 2,2			
Max. allowable inlet fuel temp (Measured at fuel inlet connection)		°C °F	80 176			
Prefilter / Water separator filtration efficiency	99%	µ	30			
Main fuel filter filtration efficiency (in accordance with ISO 19438)	98%	µ	5			
	96%	µ	4			
Governor type/make, standard		Volvo/ EMS 2.3				
Injection pump type/make		Denso HP4				

Intake and exhaust system		Inlet air temp	rpm	1500	1800	2000	2200
Charge air consumption at: (+25°C and 100kPa)	ICFN Power 185 kW	25°C	m³/min	11,6	12,6	14,4	15,2
		77°F	cfm	410	445	509	537
⚠ **See front page for important information** Max allowable air intake restriction including piping			kPa psi	6 0,9			
Heat rejection to exhaust at:	ICFN Power 185 kW		kW BTU/min	90 5135	99 5653	108,6 6176	118,7 6750
Exhaust gas temperature after turbine at:	ICFN Power 185 kW		°C °F	371 700	376 709	362 684	374 705
⚠ **See front page for important information** Max allowable back pressure in exhaust line (after turbine) Pipe dimension Ø: 102 mm			kPa psi	15 2,2	17 2,5	20 2,9	22 3,2
⚠ **See front page for important information** Max allowable temperature drop between turbine and SCR muffler inlet.			Δ°C Δ°F	15 27			
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)			kPa psi	10 1,5	11 1,6	13 1,9	14 2,0
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	ICFN Power 185 kW		m³/min cfm	23,4 826	25,1 886	27,3 964	28,9 1021

Cooling system			rpm	1500	1800	2000	2200
Heat rejection radiation from engine at:		ICFN Power 185 kW	kW BTU/min	5 307	5 290	4,8 273	5,2 296
Heat rejection to coolant at:		ICFN Power 185 kW	kW BTU/min	116 6585	123 6995	124 7040	133 7581
Radiator cooling system type				Closed circuit			
Standard radiator core area		ICFN Power 185 kW	m² foot²	0,6 6,46			
Fan diameter	650 mm	ICFN Power 185 kW	mm in	650 25,59			
Fan power consumption	650 mm pull		kW hp	9,3 13	15,8 21	19,3 26	23,9 33
Fan drive ratio	fan Ø650			1.4:1			
Coolant capacity:	engine		liter US gal	17 4,5			
	engine + standard radiator, hoses and expansion tank		liter US gal	51 13,5			
Coolant pump			drive/ratio	belt/1,40:1			
Coolant flow with standard system			l/s US gal/s	5,4 1,4	6,5 1,7	7,2 1,9	8,0 2,1
Minimum coolant flow			l/s US gal/s				6,0 1,6
Maximum outer circuit restriction incl. piping			kPa psi	40,0 5,8			
Thermostat:		start to open	°C °F	85 185			
		fully open	°C °F	95 203			
Maximum static pressure head (expansion tank height + pressure cap setting)			kPa psi	110 16,0			
Minimum static pressure head (expansion tank height + pressure cap setting)			kPa psi	85 12,3			
Standard pressure cap setting			kPa psi	100 14,5			
Maximum top tank temperature			°C °F	107 225			
Recommended Draw down capacity. The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still are functioning			liter US gal	2 0,5			

Charge air cooler system		rpm	1500	1800	2000	2200
Heat rejection to charge air cooler	ICFN Power 185 kW	kW	29,8	29,3	33,8	35,5
		BTU/min	1695	1666	1922	2019
Charge air mass flow	ICFN Power 185 kW	kg/s	0,229	0,249	0,285	0,3
Charge air inlet temp.	ICFN Power 185 kW	°C	178	166	168	167
(Charge air temp after turbo compressor)		°F	352	331	334	333
⚠ **See front page for important information** Max allowable Charge air outlet temp. (Charge air temp after charge air cooler)		°C	49	49	50	50
		°F	120	120	122	122
⚠ **See front page for important information** Maximum pressure drop over charge air cooler incl. piping		kPa	7	9	11	12
		psi	1,02	1,31	1,60	1,74
Charge air pressure (relative) (After charge air cooler)		kPa	203	182	180	174
		psi	29,44	26,40	26,11	25,24
Standard charge air cooler core area		m²	0,5			
		foot²	5,38			

Cooling performance: 0,6 m² radiator and 650mm fan, pull

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

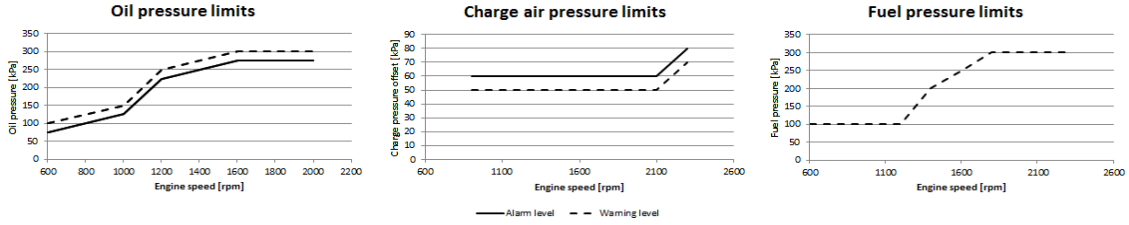
		ICFN Power 185 kW					
Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	m^3/s	ft^3/s	Pa	psi
1500	181	62	143	7,4	261,3	0	
	246	61	141	7,2	254,3	100	0,015
		58	137	6,7	236,6	200	0,029
		54	130	6,1	215,4	300	0,044
2200	185	63	146	9,4	332,0	0	
	252	63	145	9,3	328,4	100	0,015
		62	144	9	317,8	200	0,029
		61	141	8,6	303,7	300	0,044

Engine management system

Functionality	Alternatives			Default setting
Governor mode	Droop	Isochronous		Isochronous
Governor droop	10	125	Nm/rpm	
Governor response	Adjustable PI constants			
Idle speed	600	800	rpm	600
Stop function				Replaced by "Ignition of stop engine"
Preheating function	Ignition	Request	Request + temp	If preheat is available, preheat will be active at ignition on if temp low or demanded by driver.
Lamp test				No lamp test, not used any longer
Ignition of stop engine	Yes	No		No

Engine sensors and switch settings			Alarm level		Engine protection	
Parameter		**Unit**	**Setting range**	**Default setting**	**Level**	**Action. Default/Alternative**
Oil temp		°C		125	125	Derate/Shut down
Oil pressure	Low idle	kPa		75,0	75	Shut down.
	Rated speed	kPa		275	275	Shut down.
Oil level				Low level		
Coolant temp		°C		107	107	Derate/Shut down
Coolant level			See cooling system	On	Low level	Derate/Shut down
Fuel feed pressure	Low idle	kPa		100		
	Rated speed			300		
Water in fuel				Alarm when closed		
EGR temp		°C		210	210	Derate/Shut down
Air filter pressure drop				5kPa		
Altitude, above sea		m			700	Automatic derating, see section derating
Charge air temp		°C		120	120	Derate/Shut down
Charge air pressure		kPa		Alarm map value	Alarm map value	Derate/Shut down
SCR temp		°C		515	515	Derate

Parameter	Warning	Alarm	Derated 0% to engine protection map	Derated 100% to engine protection map	Forced idle after 5 sec	Forced shut down after 0 sec
Coolant temp	102°C	107°C	107°C	112°C		
Oil temp	120°C	125°C	125°C	130°C		
Low oil pressure	Warning map value	Alarm map value				Alarm map value
High charge air temp	115°C	120°C	120°C	140°C		
High charge air pressure	Warning map value	Alarm map value		Alarm map value		
EGR temp	200°C	210°C	210°C	220°C		



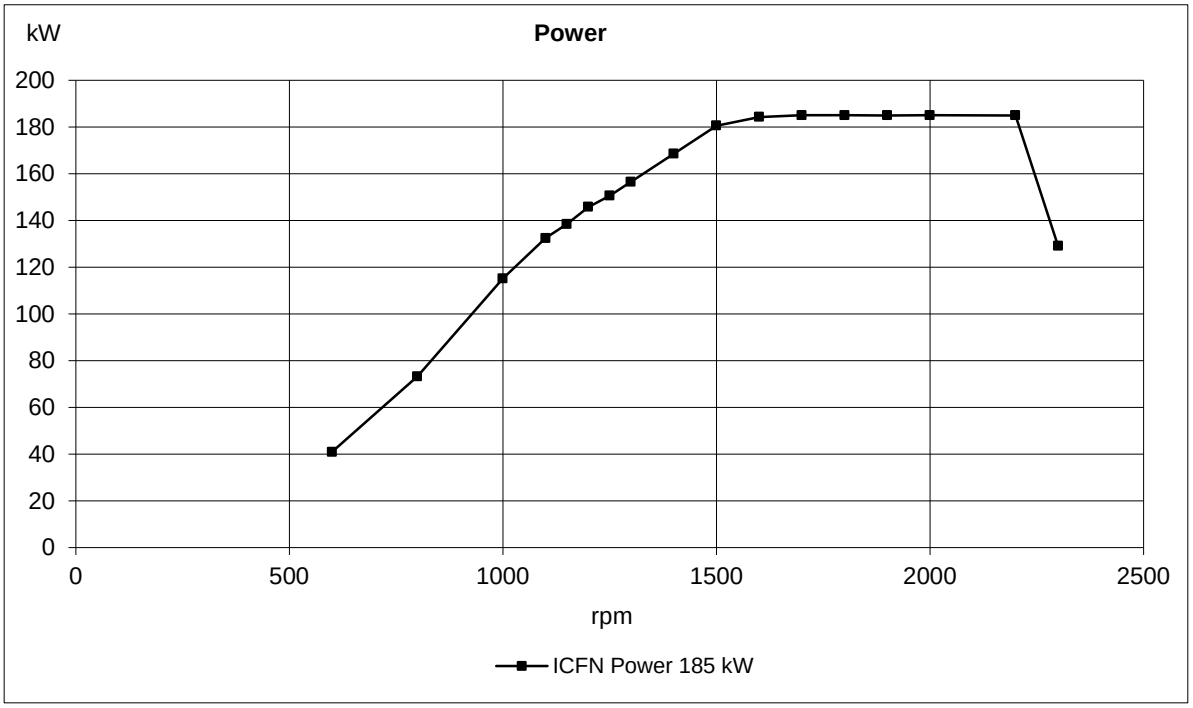
Electrical system

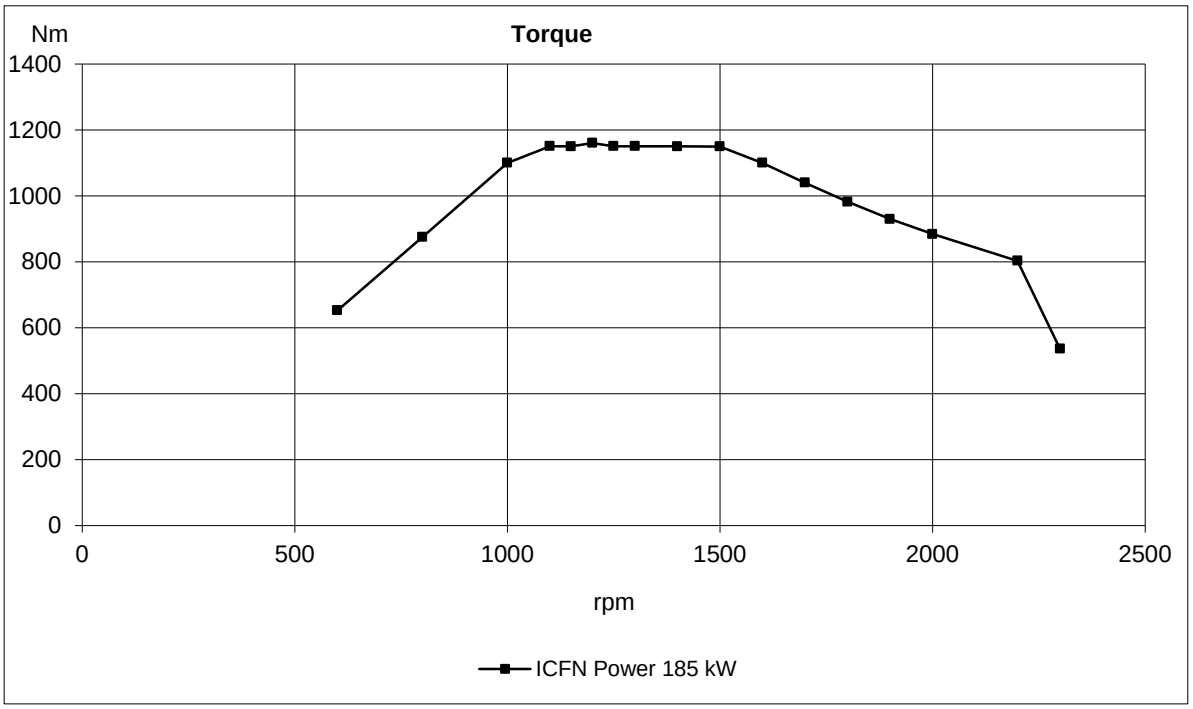
Voltage and type				24V
Alternator:	make			MELCO
	output	A		110/130
	tacho output	Hz/alternator rev.		
	drive ratio			
Starter motor:	make			MELCO
	type			85P50/90P55
	output		kW	5 / 5.5
			hp	6.8 / 7.5
Number of teeth on:	flywheel			137
	starter motor			10 / 12 teeth
Inlet manifold heater (at 20 V)			kW	4
Power relay for the manifold heater			A	200

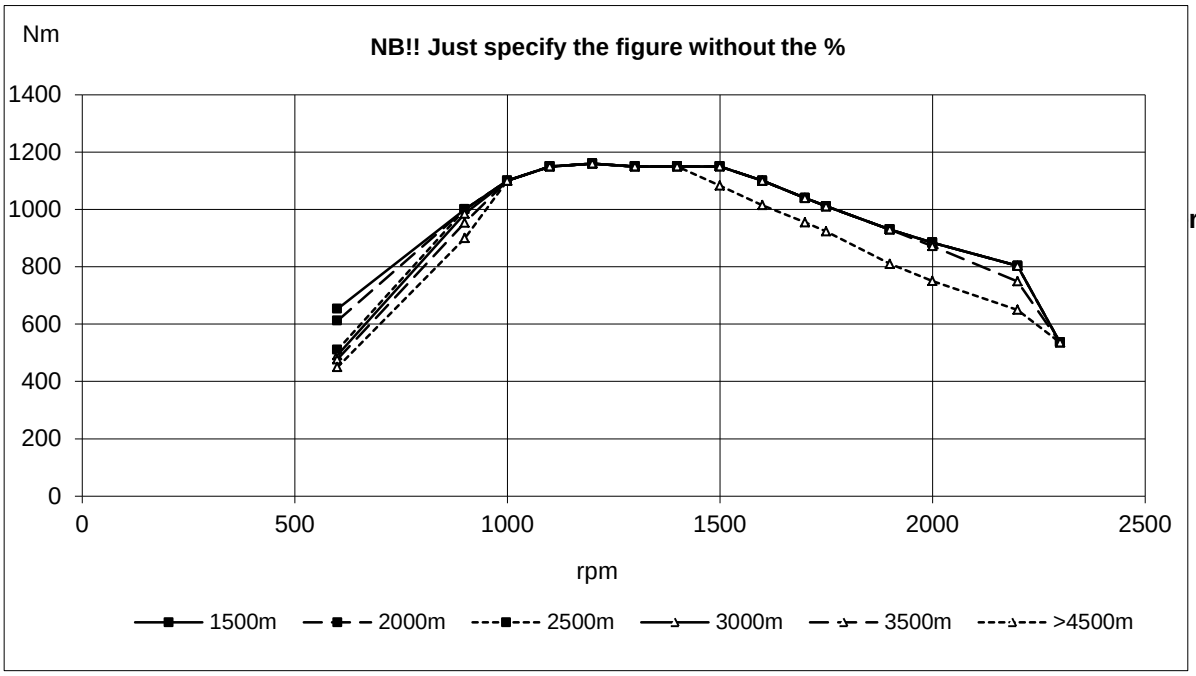
Conditions: (5 mΩ main circuit resistance@ 20°C)	**Temperature**	**°C**		**25**	**0**	**-15**
	Battery	**Ah / CCA**		**140/800**	**140/800**	**140/800**
Crank speed		rpm		185	160	120
Crank current		A		220	300	470
Starter input power during crank		kW		4,91	5,90	6,94
Battery power during crank		kW		5,15	6,31	7,50
Min battery @ 0°C		Ah / CCA				

Power take off		**rpm**	**1400**	**1800**	**2000**	**2200**
Front end in line with crank shaft max:*	0.02 kgm^2	Nm	1064,0	743,0	740	833
Flywheel		lbf ft	785	548	546	614
SAE 2, STD 10” & 11,5 ”, 1.303 kgm2	0.03 kgm^2	Nm	1030,0	706,0	697	786
		lbf ft	760	521	514	580
	0.04 kgm^2	Nm	996,0	663,0	654	729
		lbf ft	735	489	482	538
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	45,0	57,9	64,3	70,7
		hp	61	79	87	96
	max down	kW	45,0	58,0	64,3	70,7
		hp	61	79	87	96
	max right	kW	21,1	27,2	30,2	33,2
		hp	29	37	41	45
Maximum power on Rear PTO on top of flywheel housing(REPTO):*		kW	75			
		hp	102			
Speed ratio direction of rotation viewed from flywheel side			1:1 Counter clockwise			
Maximum torque on PTO at compressor position:*		Nm	200			
		lbf ft	148			
Speed ratio direction of rotation viewed from flywheel side			1.026:1 Counter clockwise			
Timing gear at hydraulic pump PTO max:*		Nm	80			
		lbf ft	59			
Speed ratio direction of rotation viewed from flywheel side			1.3:1 Clockwise			
Max allowed bending moment in flywheel housing	SAE2	Nm	4600			
		lbf ft	3393			
Max. rear main bearing load		N	4250			
		lbf	955,4			

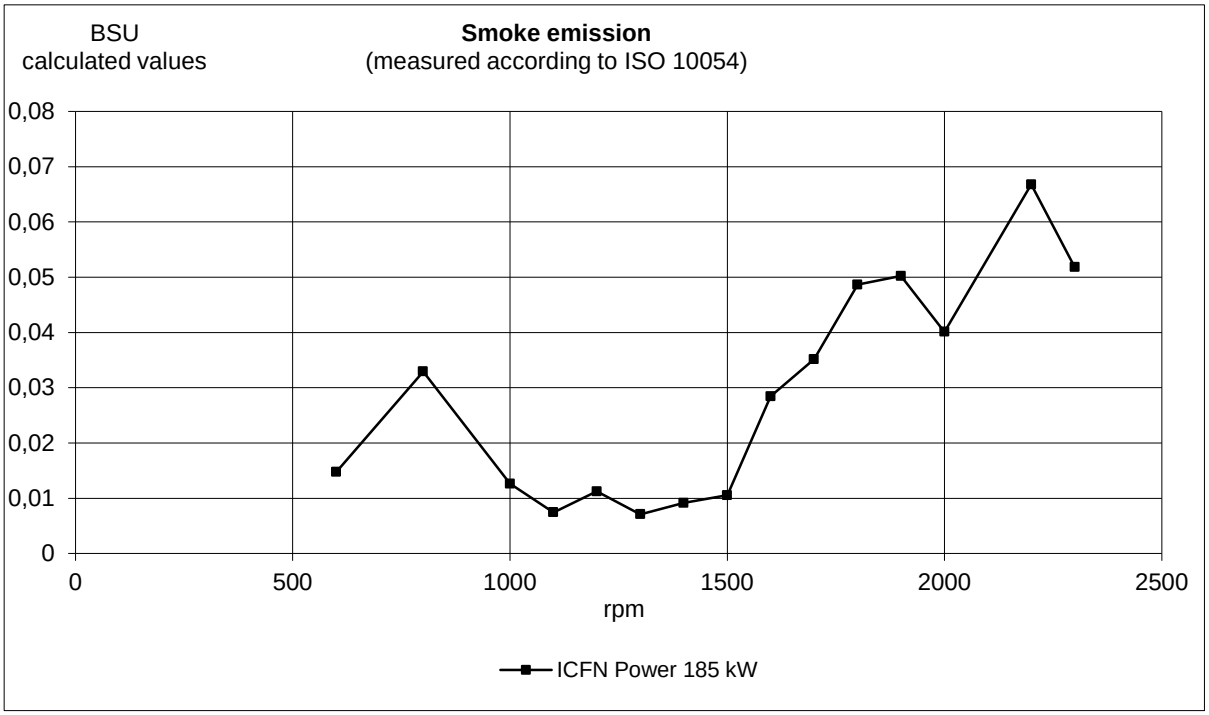
**** Maximum allowed torque at individual PTO´s.***
If more then one PTO output is used simultaniusly, calculations needs to be performed to determine available maximum. Available torque depends on application inertia.

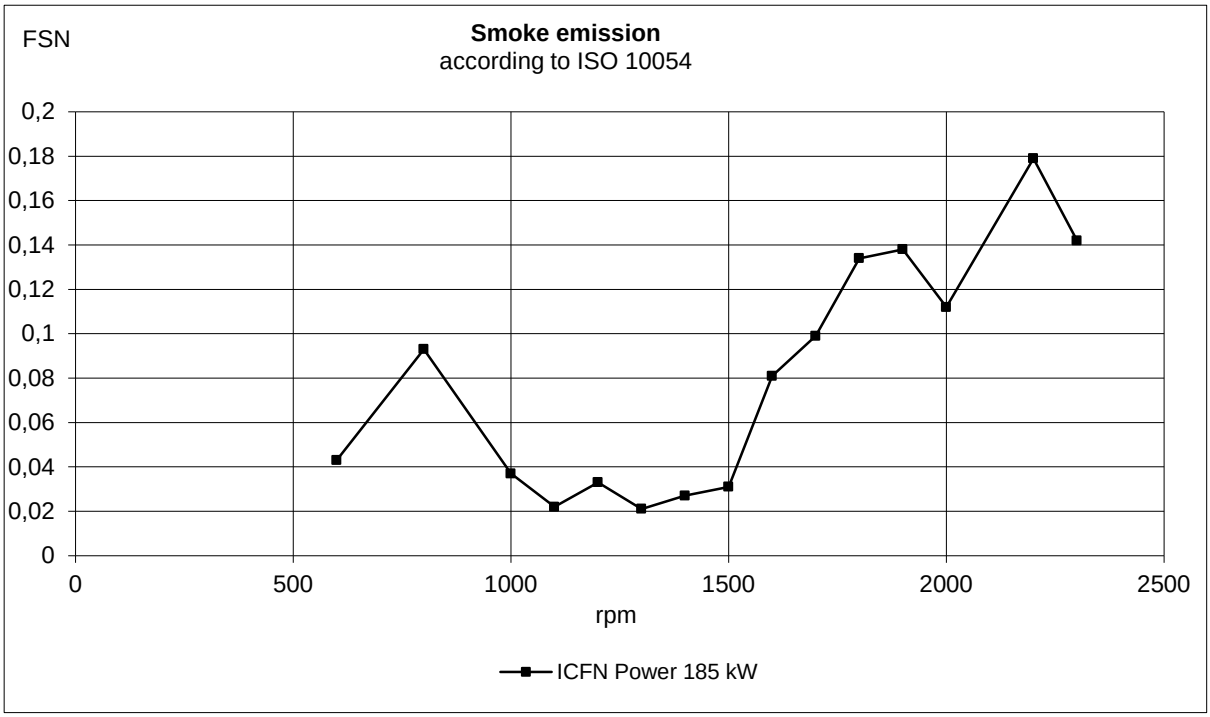

kW
Power
200
180
160
140
120
100
80
60
40
20
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 185 kW

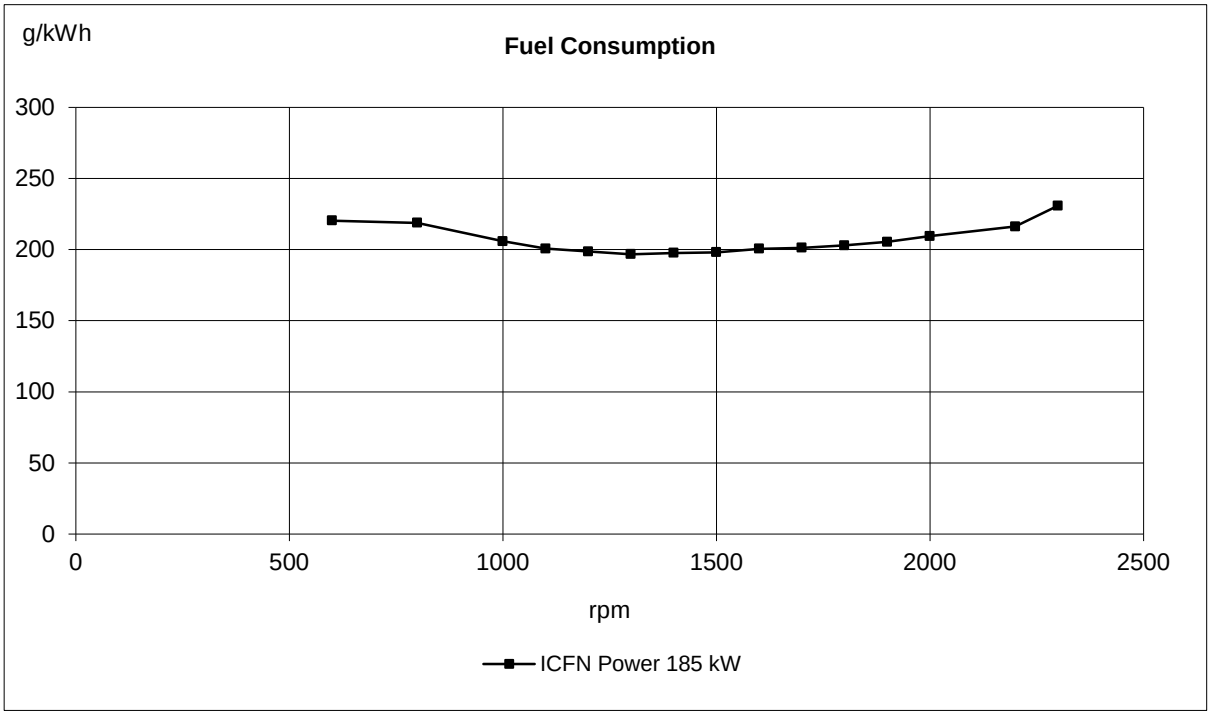

Nm
Torque
1400
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 185 kW

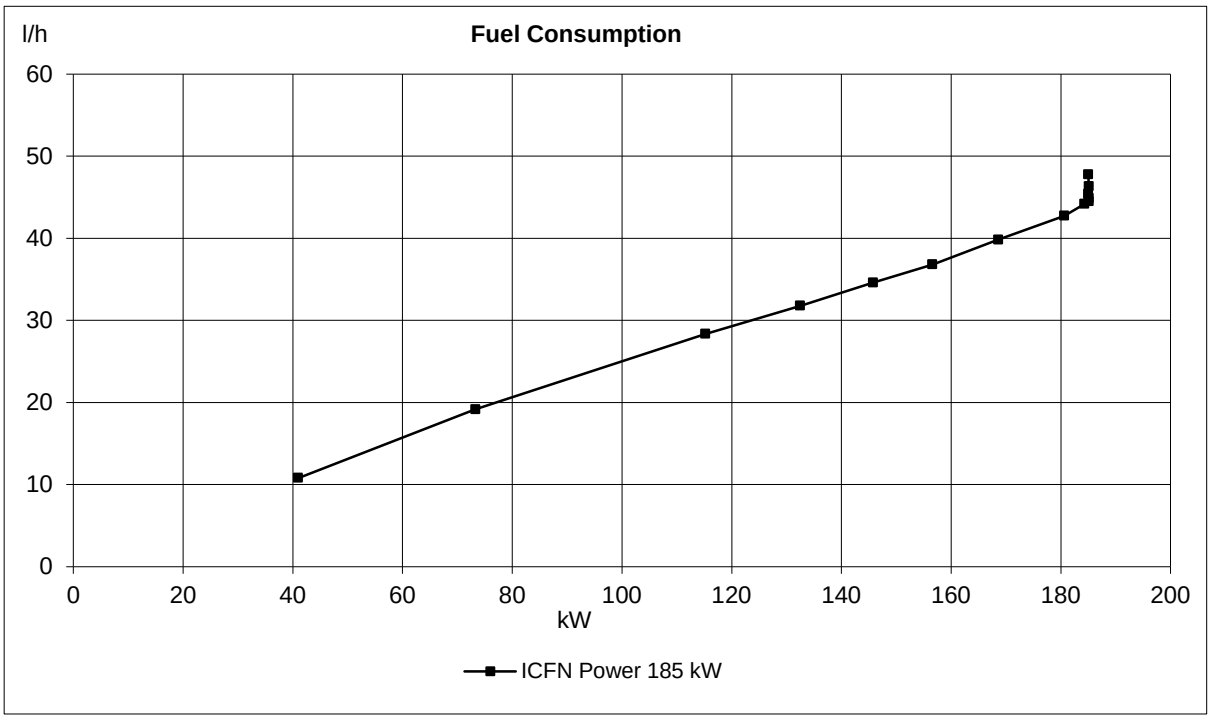

Nm
NB!! Just specify the figure without the %
1400
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
2500
rpm
1500m
2000m
2500m
3000m
3500m
>4500m

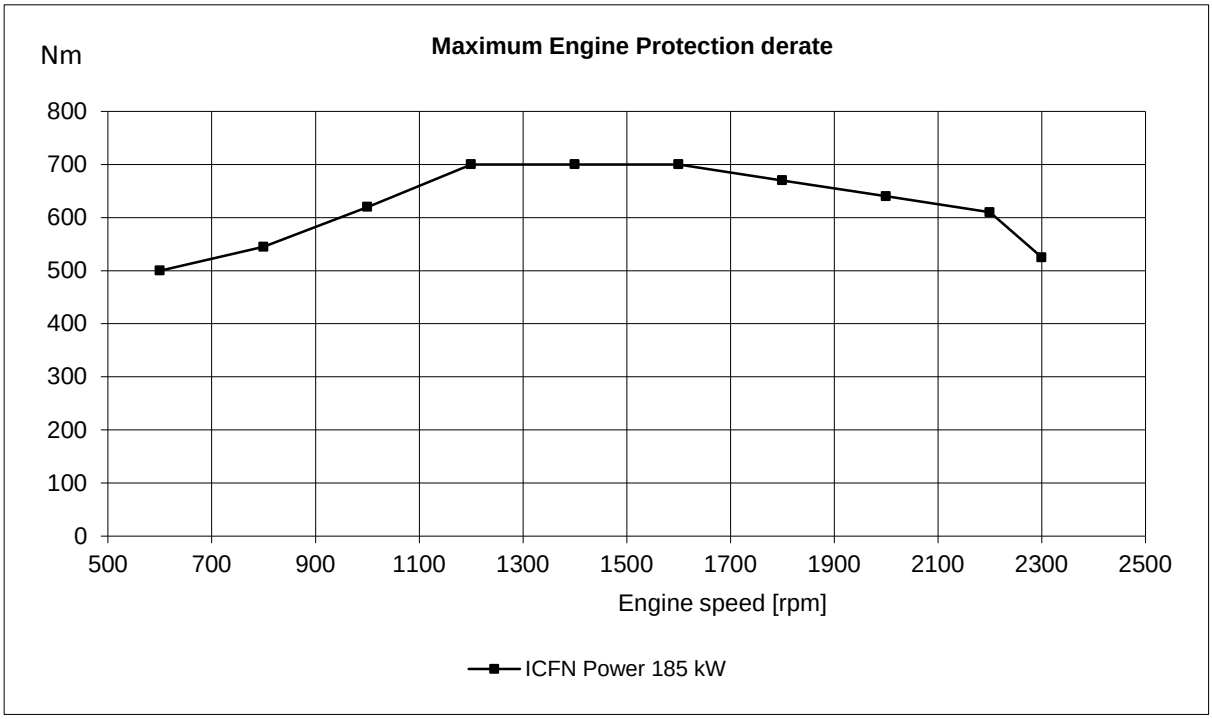
rat

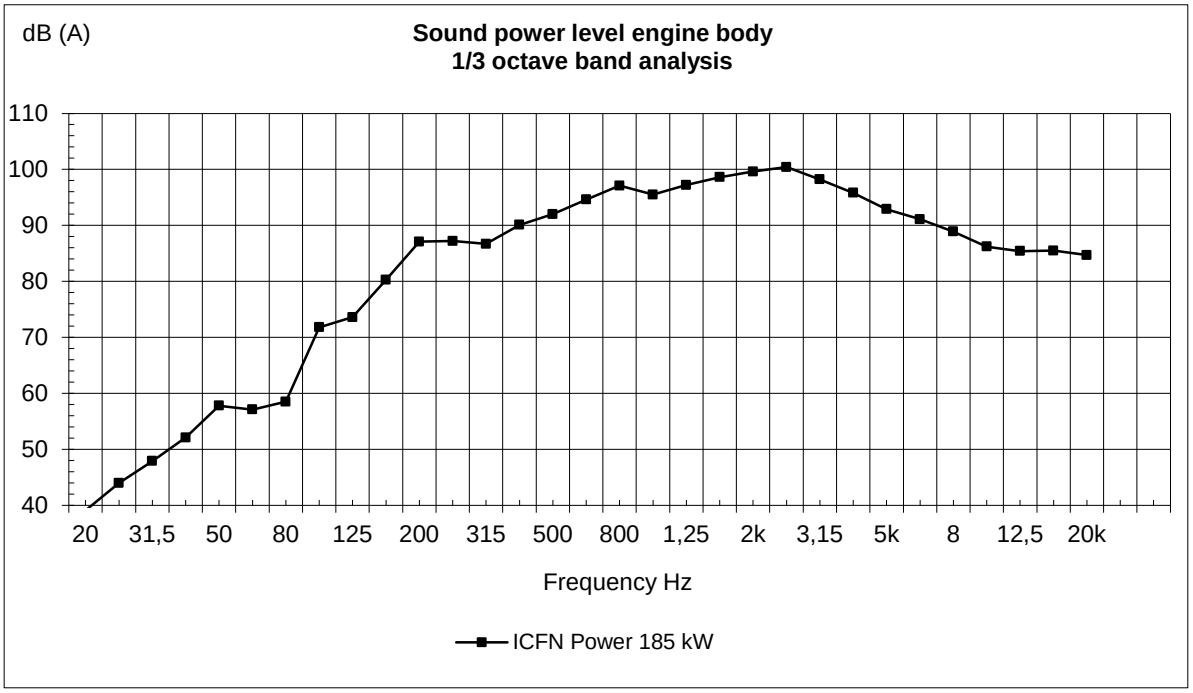

BSU
calculated values
Smoke emission
(measured according to ISO 10054)
0,08
0,07
0,06
0,05
0,04
0,03
0,02
0,01
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 185 kW

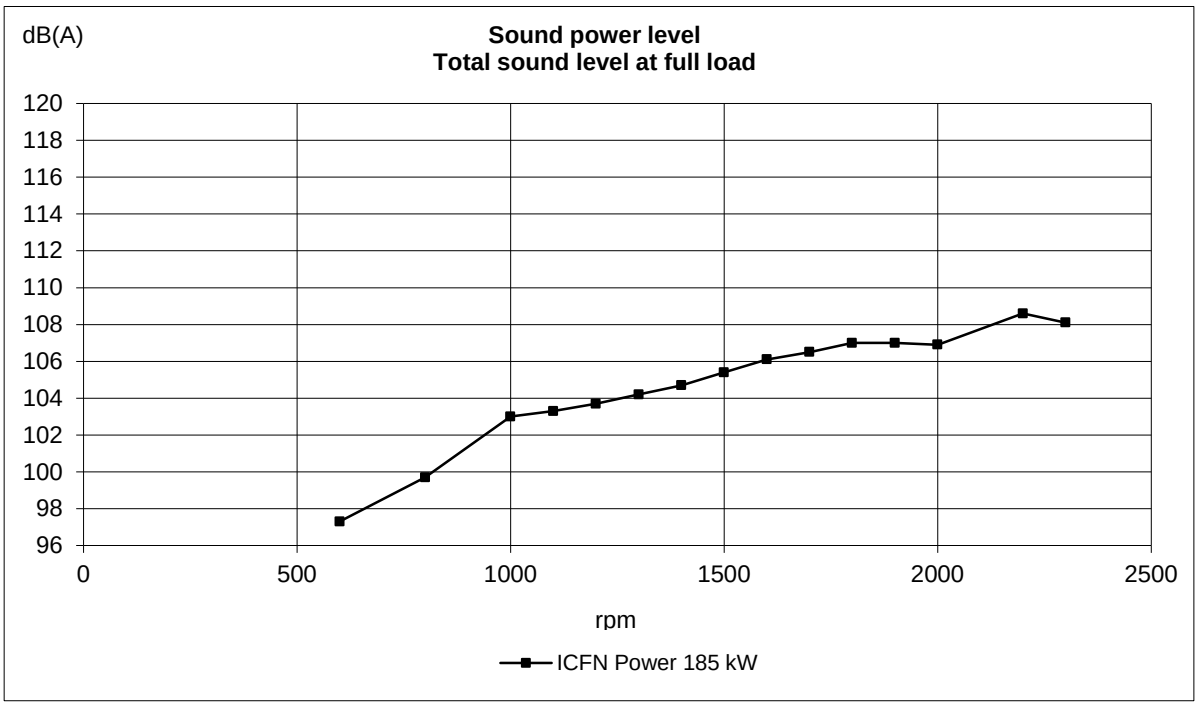

FSN
Smoke emission
according to ISO 10054
0,2
0,18
0,16
0,14
0,12
0,1
0,08
0,06
0,04
0,02
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 185 kW

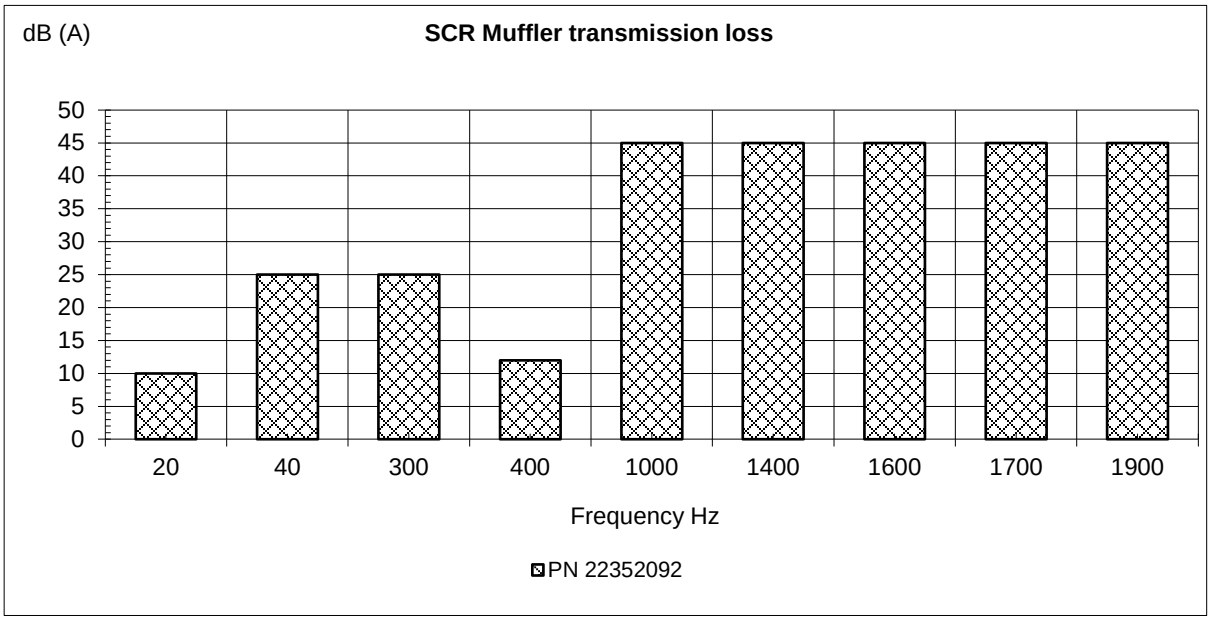

g/kWh
Fuel Consumption
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 185 kW

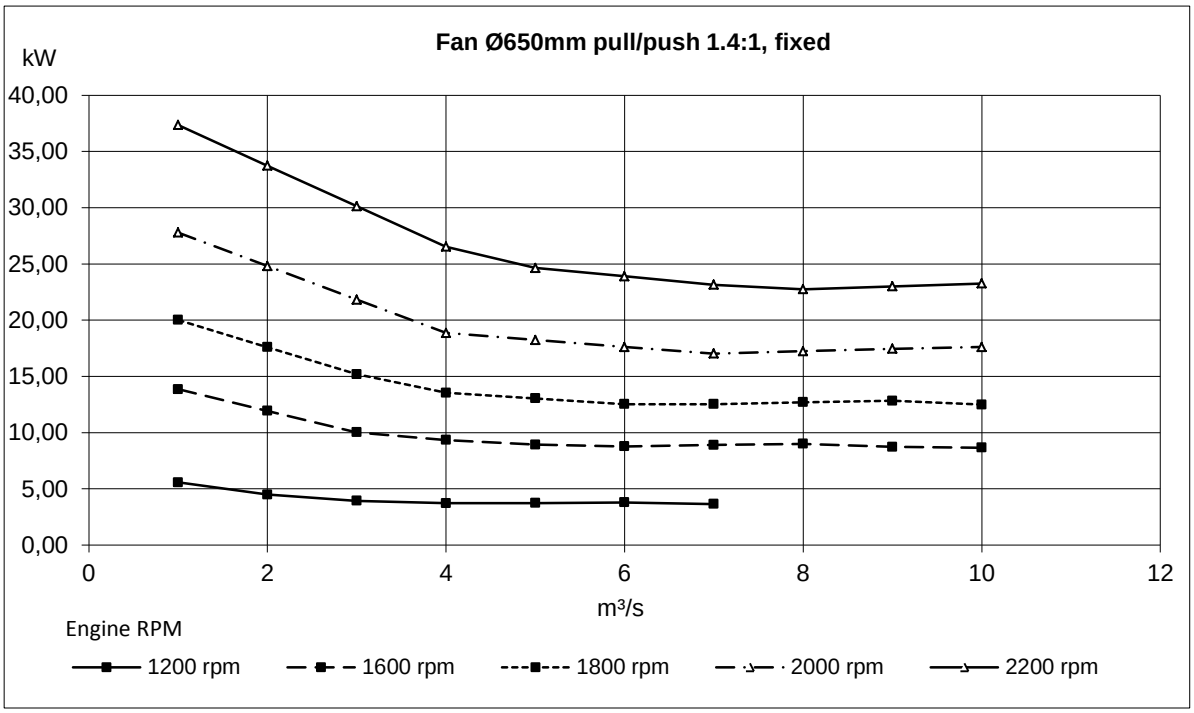

l/h
Fuel Consumption
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
kW
ICFN Power 185 kW

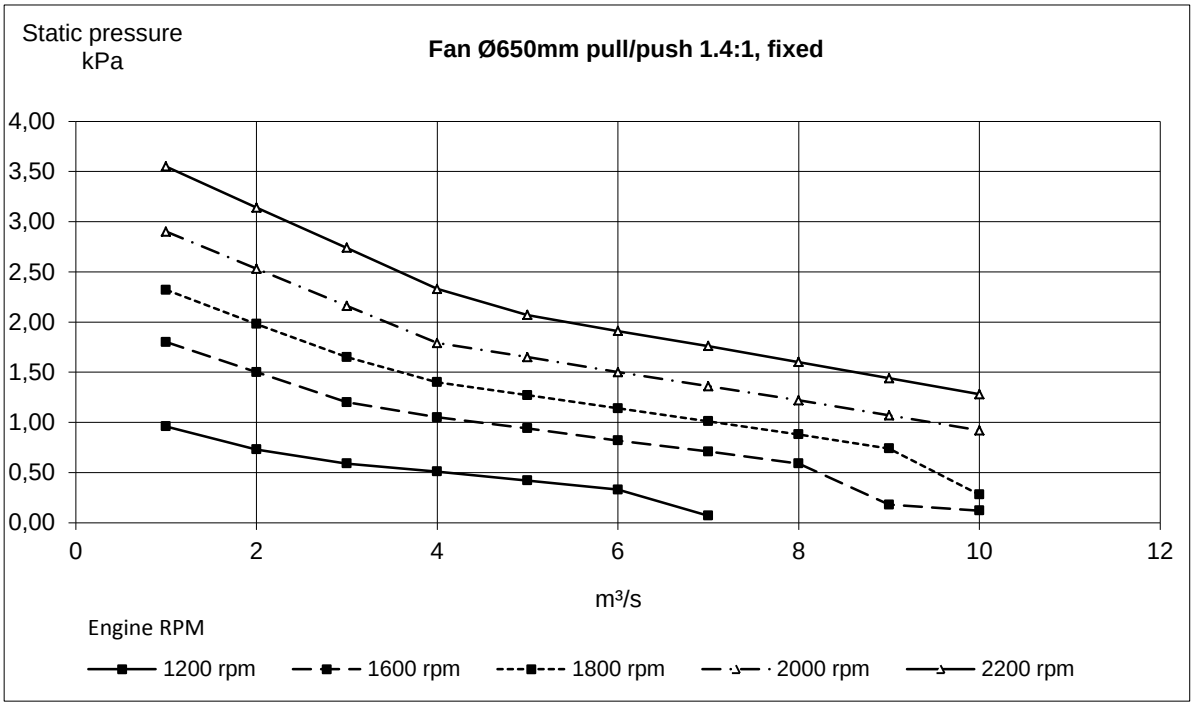

Maximum Engine Protection derate
Nm
800
700
600
500
400
300
200
100
0
500
700
900
1100
1300
1500
1700
1900
2100
2300
2500
Engine speed [rpm]
ICFN Power 185 kW

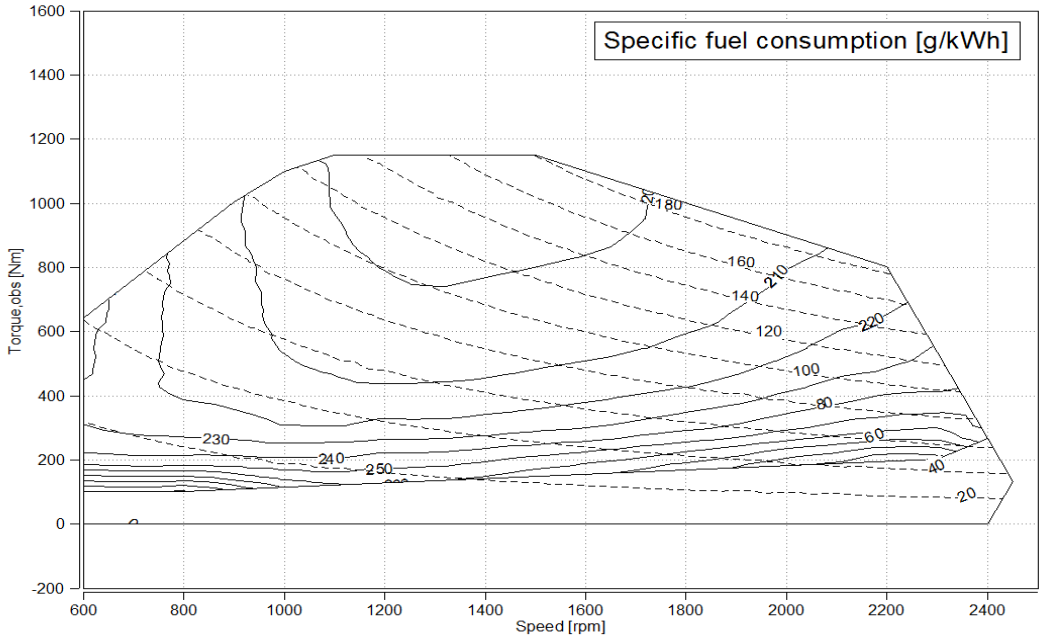

dB (A)
Sound power level engine body
1/3 octave band analysis
110
100
90
80
70
60
50
40
20
31,5
50
80
125
200
315
500
800
1,25
2k
3,15
5k
8
12,5
20k
Frequency Hz
ICFN Power 185 kW

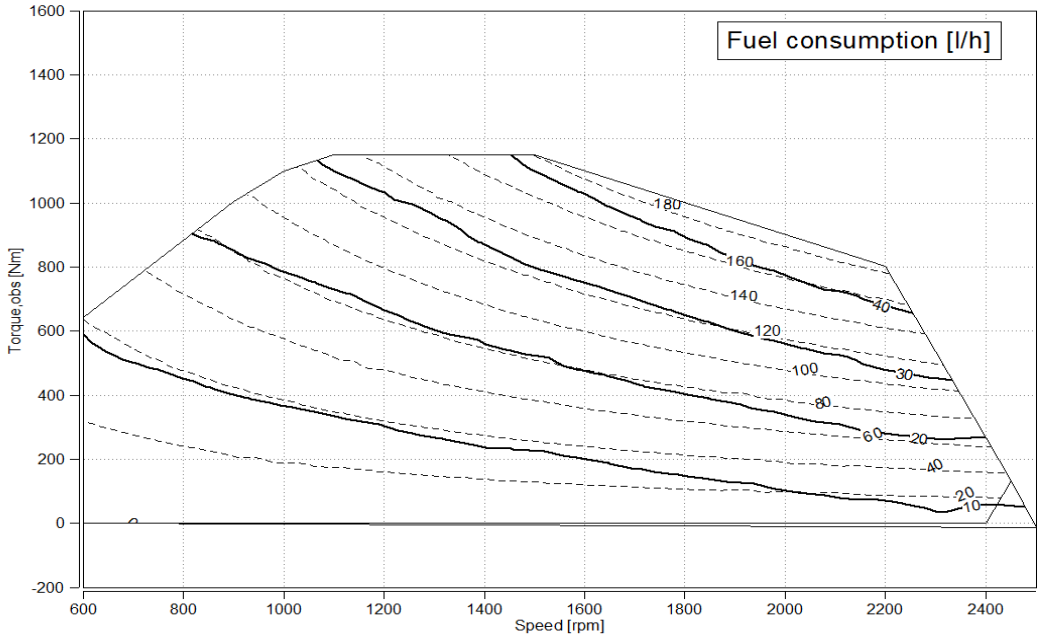

dB(A)
Sound power level
Total sound level at full load
120
118
116
114
112
110
108
106
104
102
100
98
96
0
500
1000
1500
2000
2500
rpm
ICFN Power 185 kW


dB (A)
SCR Muffler transmission loss
50
45
40
35
30
25
20
15
10
5
0
20
40
300
400
1000
1400
1600
1700
1900
Frequency Hz
PN 22352092


Fan Ø650mm pull/push 1.4:1, fixed
kW
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
0
2
4
6
8
10
12
m³/s
Engine RPM
1200 rpm
1600 rpm
1800 rpm
2000 rpm
2200 rpm


Static pressure
kPa
Fan Ø650mm pull/push 1.4:1, fixed
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
0
2
4
6
8
10
12
m³/s
Engine RPM
1200 rpm
1600 rpm
1800 rpm
2000 rpm
2200 rpm

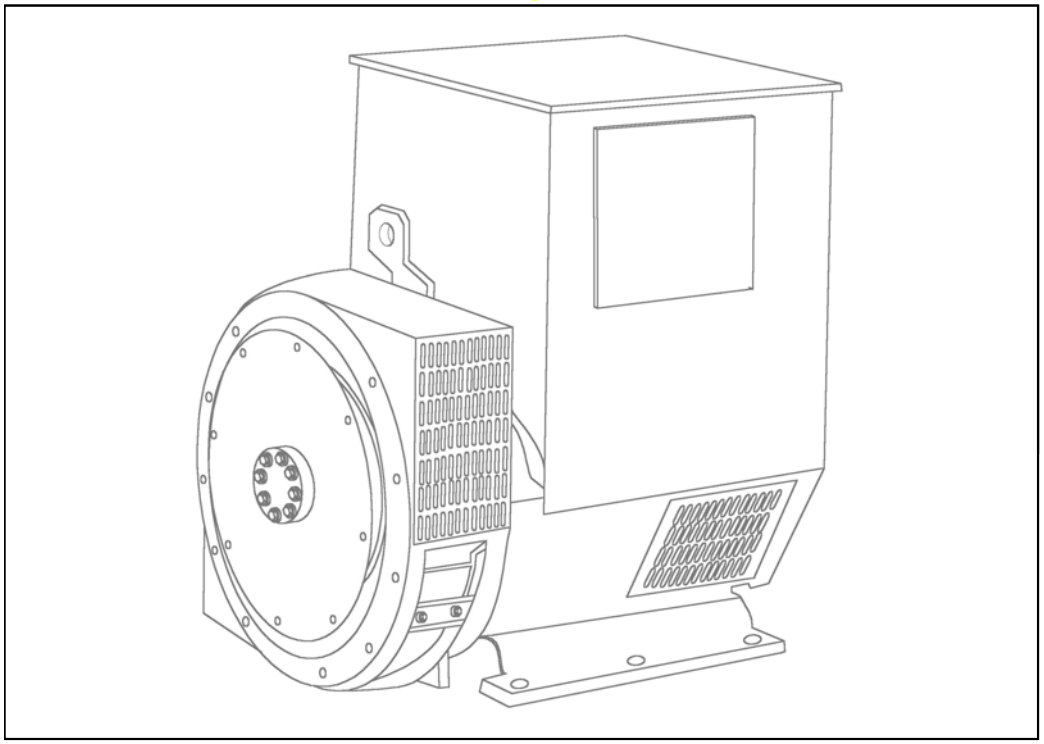

Specific fuel consumption [g/kWh]
Torque,obs [Nm]
Speed [rpm]
1600
1400
1200
1000
800
600
400
200
0
-200
600
800
1000
1200
1400
1600
1800
2000
2200
2400
180
160
210
140
120
220
100
80
230
60
240
250
40
20


Fuel consumption [l/h]
Torque,obs [Nm]
Speed [rpm]
1600
1400
1200
1000
800
600
400
200
0
-200
600
800
1000
1200
1400
1600
1800
2000
2200
2400
180
160
140
70
120
100
30
80
60
20
40
20
10

STAMFORD®

UCDI274K - Winding 311 Single Phase

Technical Data Sheet



STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

SX460 AVR - STANDARD
With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

AS440 AVR
With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR
This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

MX321 AVR
The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, over voltage protection built-in and short circuit current level adjustments as an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE
All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th ...) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX
Standard generators are reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS
All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION
The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE
Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES
All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5 C by which the operational ambient temperature exceeds 40 C.
Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

APPROVED DOCUMENT

UCDI274K

STAMFORD

WINDING 311 Single Phase

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.0 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H					
PROTECTION	IP23					
RATED POWER FACTOR	0.8					
STATOR WINDING	DOUBLE LAYER CONCENTRIC					
WINDING PITCH	TWO THIRDS					
WINDING LEADS	12					
STATOR WDG. RESISTANCE	0.008 Ohms AT 22°C DOUBLE DELTA CONNECTED					
ROTOR WDG. RESISTANCE	2.08 Ohms at 22°C					
EXCITER STATOR RESISTANCE	20 Ohms at 22°C					
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C					
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others					
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING LINEAR LOAD < 5.0%					
MAXIMUM OVERSPEED	2250 Rev/Min					
BEARING DRIVE END	BALL. 6315-2RS (ISO)					
WEIGHT COMP. GENERATOR	727 kg					
WEIGHT WOUND STATOR	304 kg					
WEIGHT WOUND ROTOR	272.6 kg					
WR² INERTIA	2.3934 kgm^2					
SHIPPING WEIGHTS in a crate	740 kg					
PACKING CRATE SIZE	123 x 67 x 103(cm)					
	50 Hz			60 Hz		
TELEPHONE INTERFERENCE	THF<2%			TIF<50		
COOLING AIR	0.58 m³/sec 1230 cfm			0.69 m³/sec 1463 cfm		
VOLTAGE DOUBLE DELTA	220/110	230/115	240/120	220/110	230/115	240/120
VOLTAGE PARALLEL DELTA	110	115	120	110	115	120
kVA BASE RATING FOR REACTANCE VALUES	150	150	150	155	166	175
Xd DIR. AXIS SYNCHRONOUS	2.52	2.30	2.12	2.99	2.93	2.84
X'd DIR. AXIS TRANSIENT	0.12	0.11	0.10	0.14	0.14	0.13
X"d DIR. AXIS SUBTRANSIENT	0.08	0.07	0.07	0.09	0.09	0.09
Xq QUAD. AXIS REACTANCE	1.13	1.03	0.95	1.34	1.31	1.27
X"q QUAD. AXIS SUBTRANSIENT	0.14	0.12	0.11	0.16	0.16	0.15
X_L LEAKAGE REACTANCE	0.06	0.05	0.05	0.07	0.07	0.07
X_2 NEGATIVE SEQUENCE	0.11	0.10	0.09	0.13	0.12	0.12
X_0 ZERO SEQUENCE	0.02	0.02	0.02	0.02	0.02	0.02
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED					
T'd TRANSIENT TIME CONST.	0.049 s					
T"d SUB-TRANSTIME CONST.	0.02 s					
T'do O.C. FIELD TIME CONST.	1.27 s					
Ta ARMATURE TIME CONST.	0.018 s					
SHORT CIRCUIT RATIO	1/Xd					

APPROVED DOCUMENT

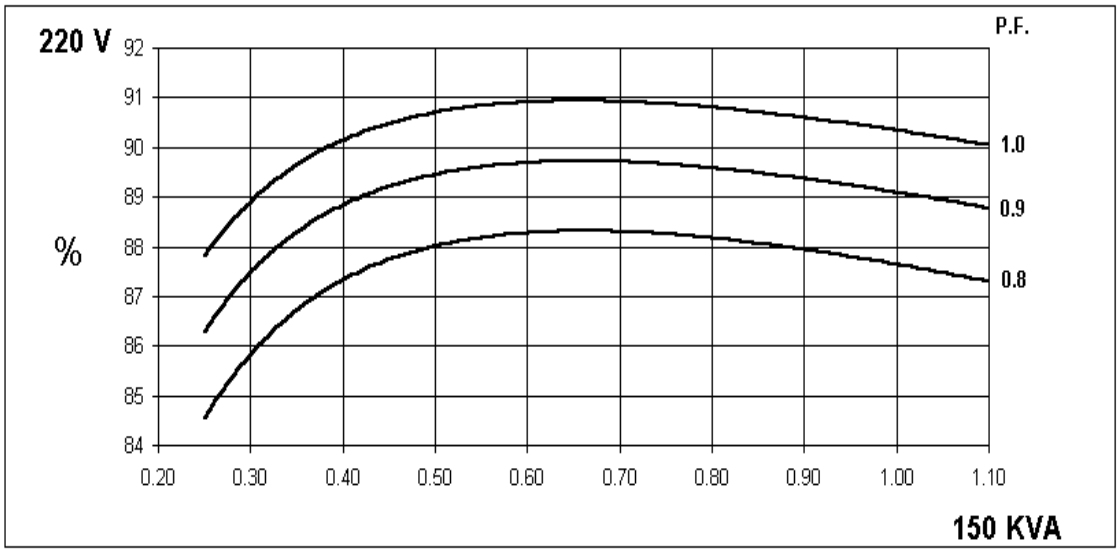
50 Hz

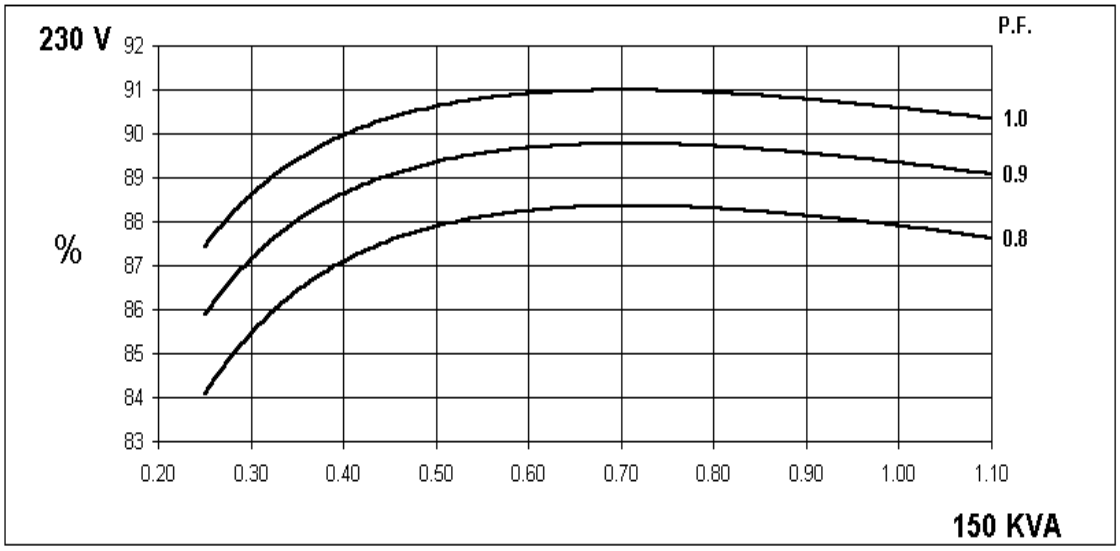
UCDI274K

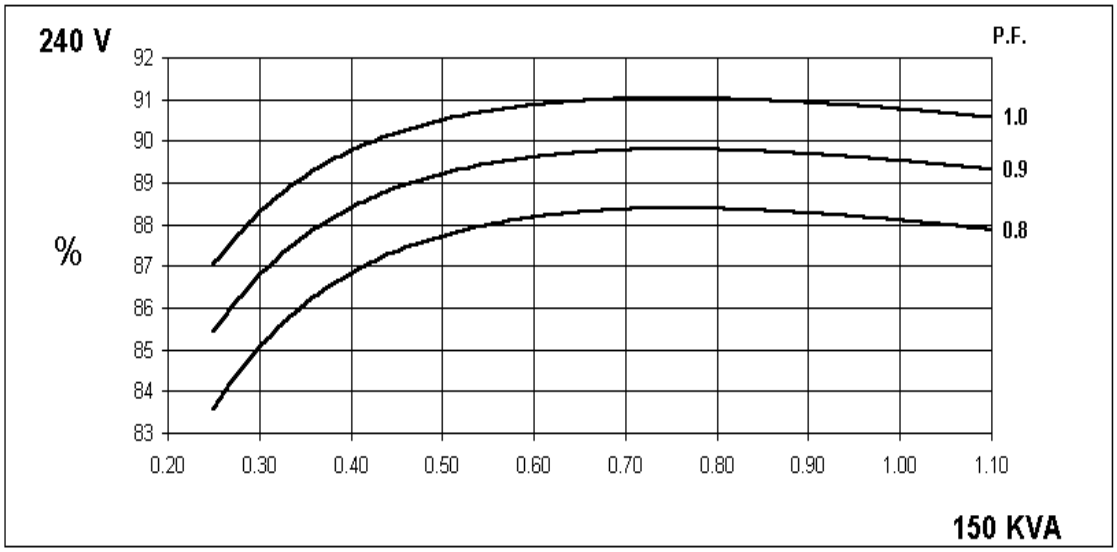
Winding 311 Single Phase

STAMFORD

SINGLE PHASE EFFICIENCY CURVES







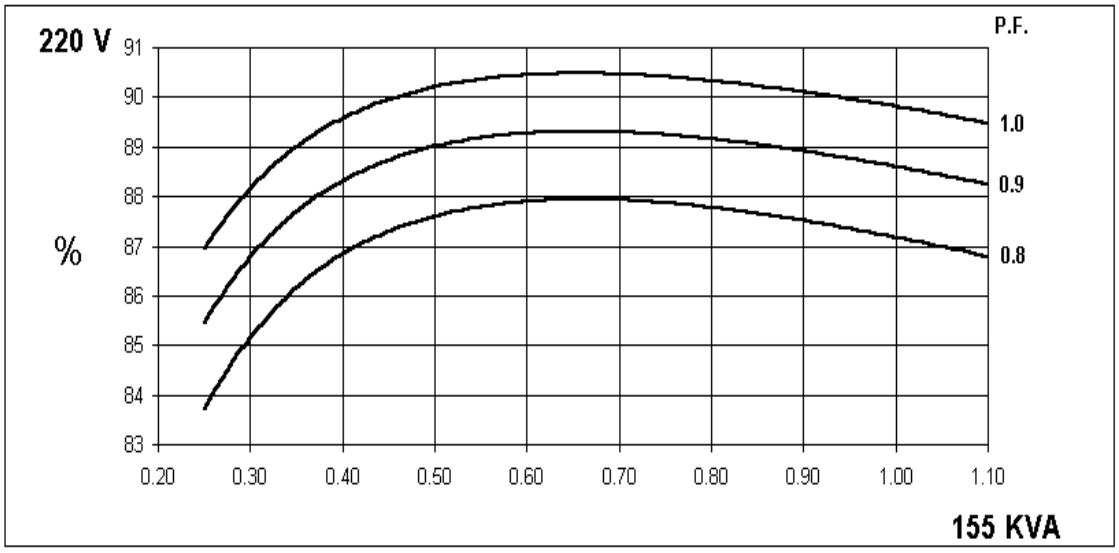
60 Hz

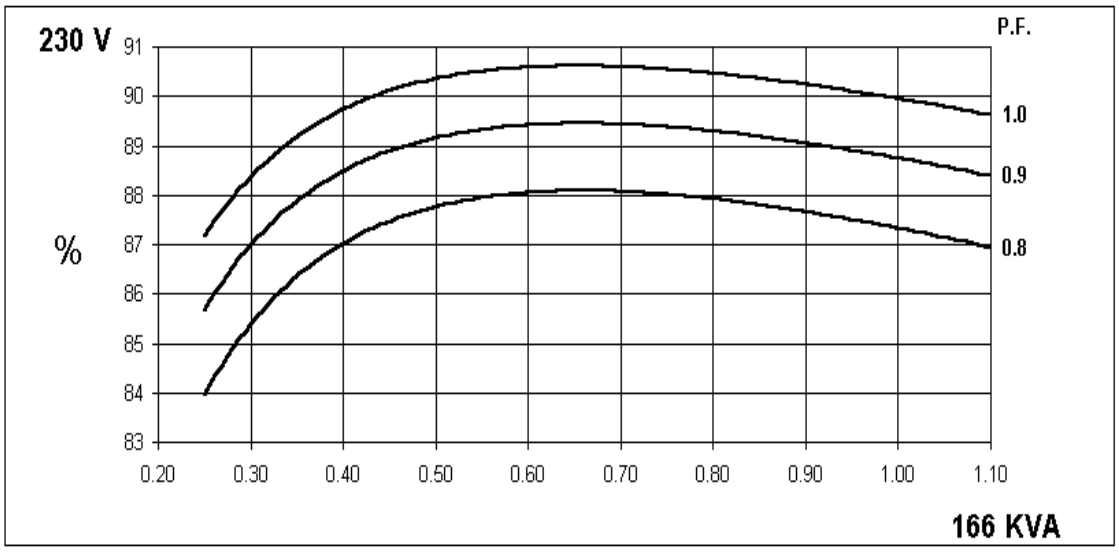
UCDI274K

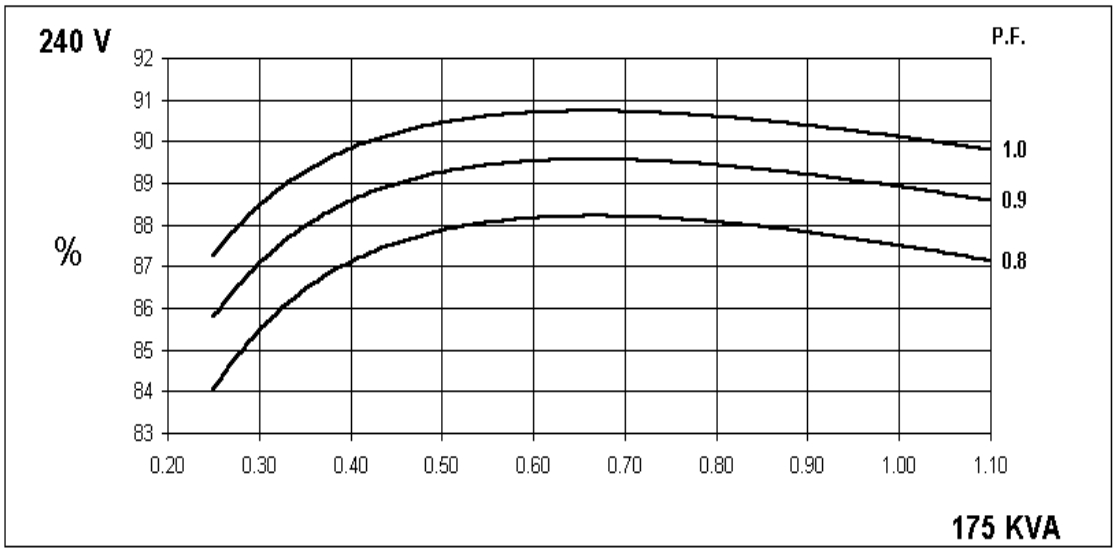
Winding 311 Single Phase

STAMFORD

SINGLE PHASE EFFICIENCY CURVES







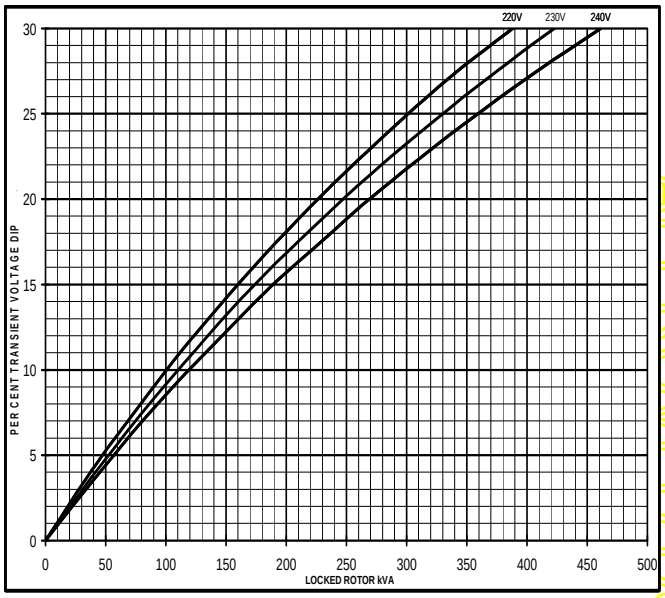
UCDI274K

Winding 311 Single Phase

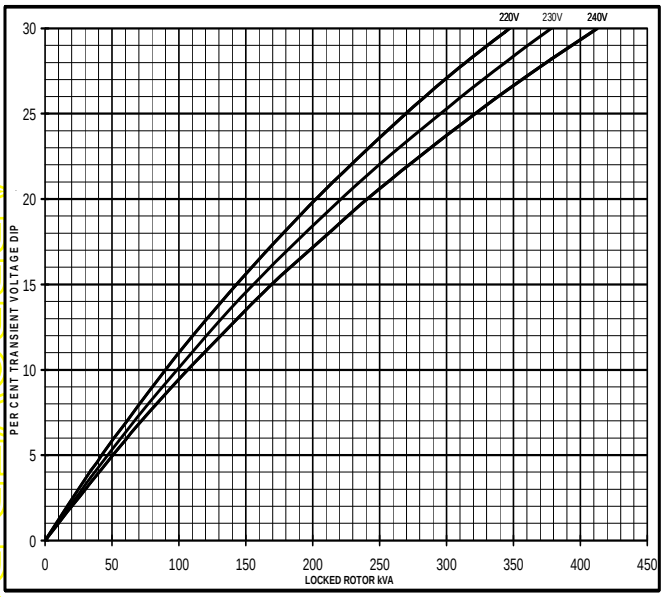
Locked Rotor Motor Starting Curve

50 Hz

MX



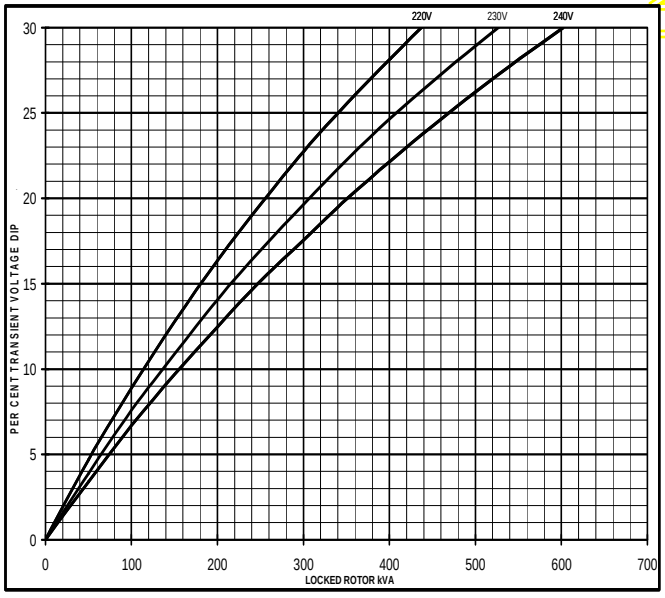
SX



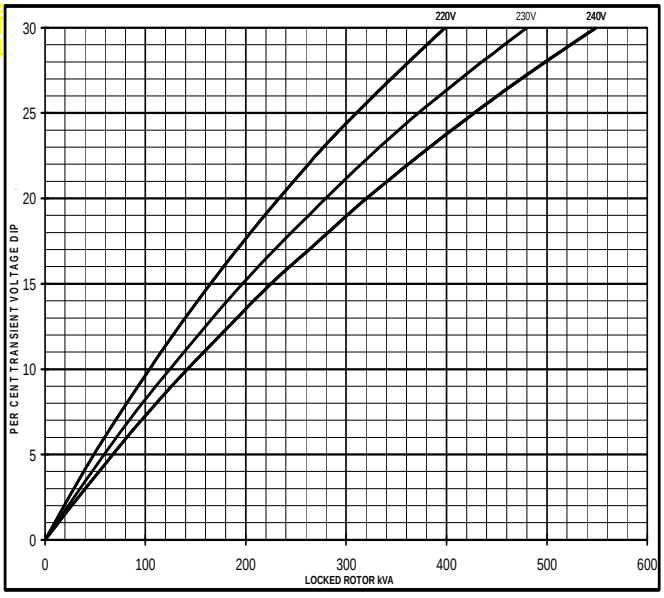
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60 Hz

MX



SX



UCDI274K

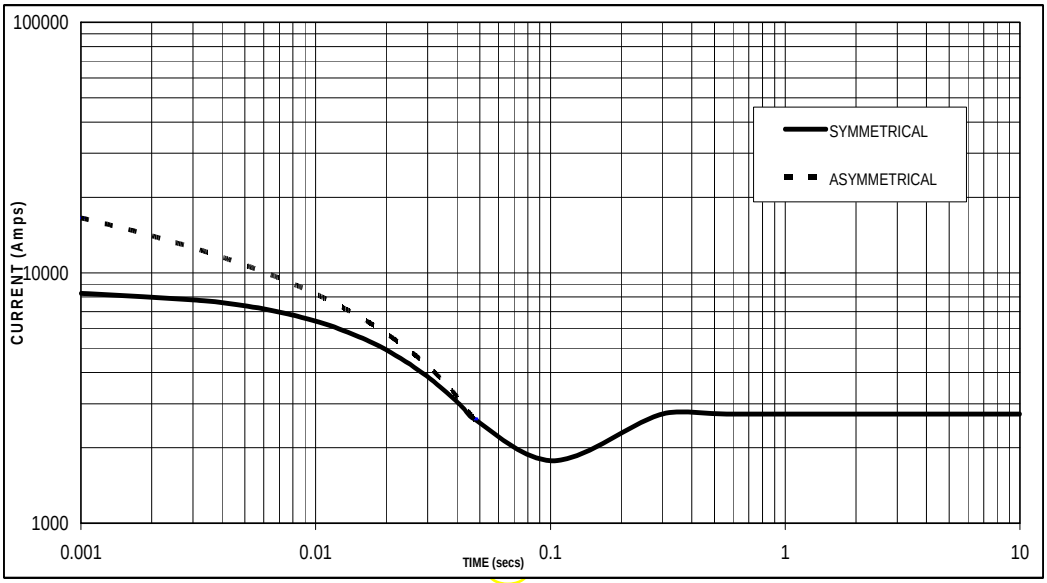
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Winding 311 Single Phase

Single Phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed

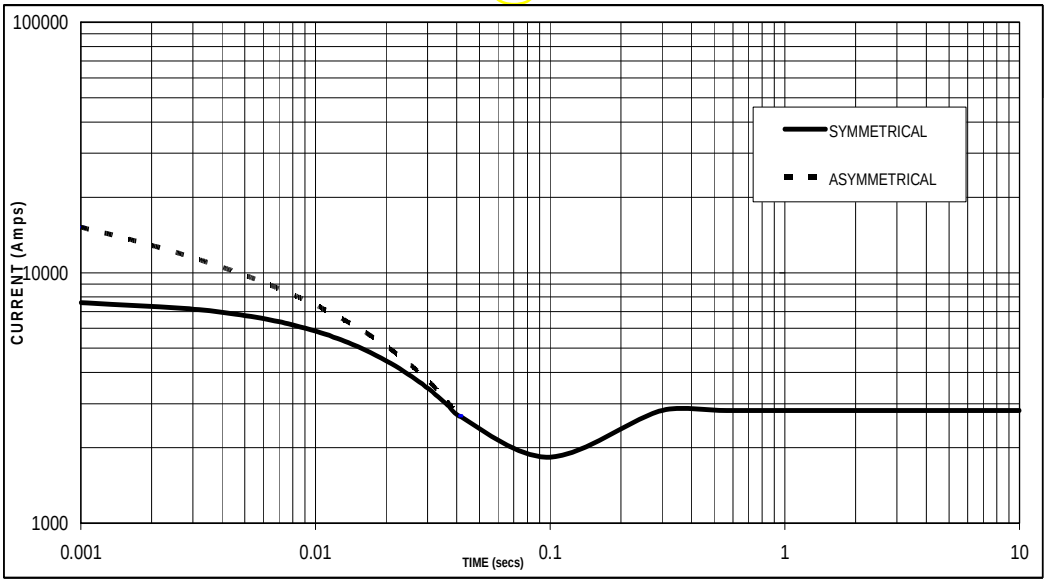
Based on Double Delta connection.

50 Hz



Sustained Short Circuit = 2730 Amps

60 Hz



Sustained Short Circuit = 2820 Amps

Note

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

Voltage	Factor
220V	X 1.00
230V	X 1.05
240V	X 1.09

The sustained current value is constant irrespective of voltage level

UCDI274K

Winding 311 Single Phase

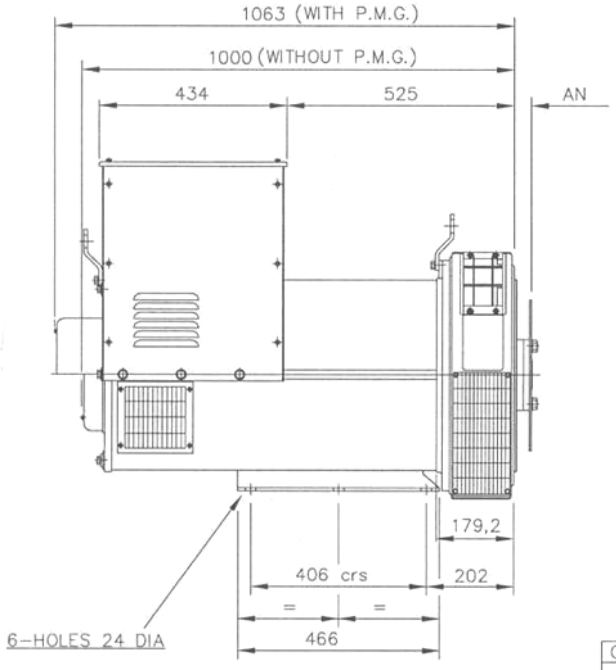
RATINGS

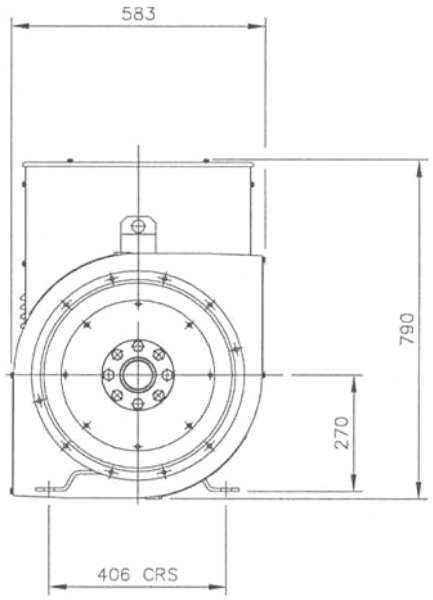
	Class - Temp Rise	Cont. F - 105/40°C **0.8pf**			Cont. H - 125/40°C **0.8pf**			Cont. F - 105/40°C **1.0pf**			Cont. H - 125/40°C **1.0pf**		
50	Double Delta (V)	220	230	240	220	230	240	220	230	240	220	230	240
	Parallel Delta (V)	110	115	120	110	115	120	110	115	120	110	115	120
	kVA	137.0	137.0	137.0	150.0	150.0	150.0	137.0	137.0	137.0	150.0	150.0	150.0
	kW	109.6	109.6	109.6	120.0	120.0	120.0	137.0	137.0	137.0	150.0	150.0	150.0
	Efficiency (%)	87.9	88.1	88.3	87.6	87.9	88.1	90.6	90.8	90.9	90.3	90.6	90.8
	kW Input	124.7	124.4	124.1	137.0	136.5	136.2	151.2	150.9	150.7	166.1	165.6	165.2

	Class - Temp Rise	Cont. F - 105/40°C **0.8pf**			Cont. H - 125/40°C **0.8pf**			Cont. F - 105/40°C **1.0pf**			Cont. H - 125/40°C **1.0pf**		
60	Double Delta (V)	220	230	240	220	230	240	220	230	240	220	230	240
	Parallel Delta (V)	110	115	120	110	115	120	110	115	120	110	115	120
	kVA	142.0	151.0	160.0	155.0	166.0	175.0	142.0	151.0	160.0	155.0	166.0	175.0
	kW	113.6	120.8	128.0	124.0	132.8	140.0	142.0	151.0	160.0	155.0	166.0	175.0
	Efficiency (%)	87.5	87.6	87.8	87.2	87.3	87.5	90.1	90.2	90.4	89.8	90.0	90.1
	kW Input	129.8	137.9	145.8	142.2	152.1	160.0	157.6	167.4	177.0	172.6	184.4	194.2

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DIMENSIONS





COUPLING DISC	AN
SAE 11,5	39,68
SAE 14	25,4

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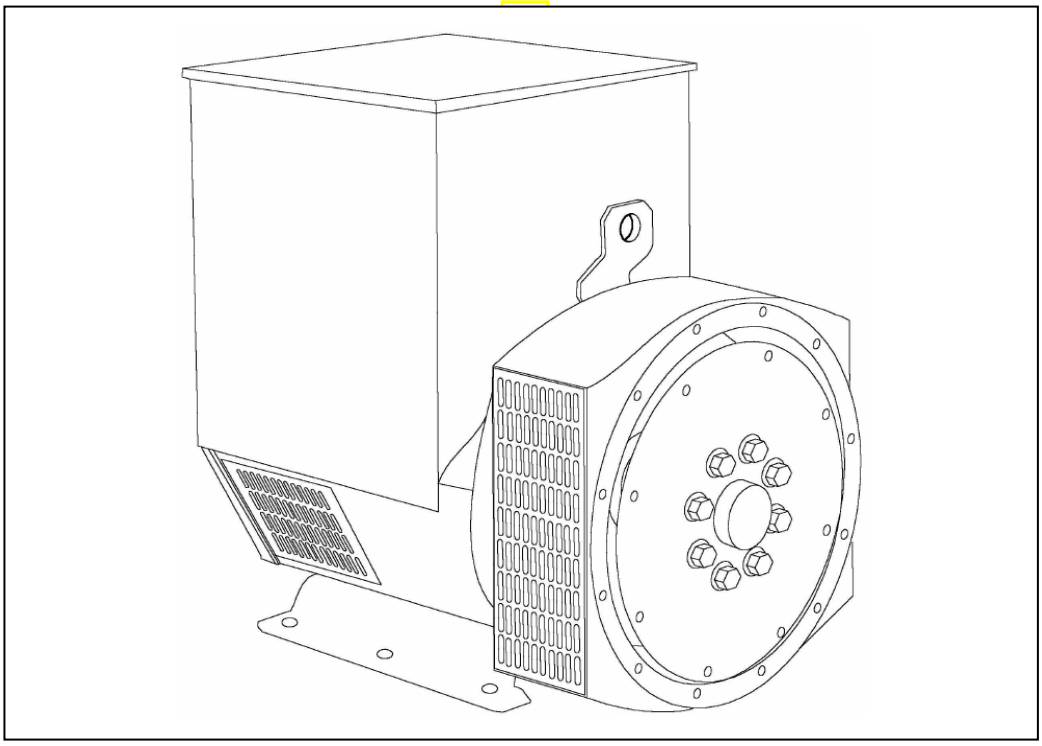
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STAMFORD®

UCI274G - Winding 311

Technical Data Sheet



SPECIFICATIONS & OPTIONS

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

SX460 AVR - STANDARD

With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

AS440 AVR

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.
If three-phase sensing is required with the PMG system the MX321 AVR must be used.
We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

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WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation.
Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5°C by which the operational ambient temperature exceeds 40°C.
Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.0 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H						
PROTECTION	IP23						
RATED POWER FACTOR	0.8						
STATOR WINDING	DOUBLE LAYER CONCENTRIC						
WINDING PITCH	TWO THIRDS						
WINDING LEADS	12						
STATOR WDG. RESISTANCE	0.0199 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED						
ROTOR WDG. RESISTANCE	1.69 Ohms at 22°C						
EXCITER STATOR RESISTANCE	20 Ohms at 22°C						
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C						
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others						
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%						
MAXIMUM OVERSPEED	2250 Rev/Min						
BEARING DRIVE END	BALL. 6315-2RS (ISO)						
BEARING NON-DRIVE END	BALL. 6310-2RS (ISO)						
	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	580 kg				598 kg			
WEIGHT WOUND STATOR	225 kg				225 kg			
WEIGHT WOUND ROTOR	210.35 kg				199.39 kg			
WR² INERTIA	1.7674 kgm²				1.7169 kgm²			
SHIPPING WEIGHTS in a crate	613 kg				630 kg			
PACKING CRATE SIZE	123 x 67 x 103 (cm)				123 x 67 x 103 (cm)			
	50 Hz				60 Hz			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	0.514 m³/sec 1090 cfm				0.617 m³/sec 1308 cfm			
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
kVA BASE RATING FOR REACTANCE VALUES	182	182	182	N/A	205	218	218	231
Xd DIR. AXIS SYNCHRONOUS	2.15	1.94	1.80	-	2.43	2.31	2.11	2.06
X'd DIR. AXIS TRANSIENT	0.19	0.17	0.16	-	0.21	0.20	0.18	0.18
X"d DIR. AXIS SUBTRANSIENT	0.13	0.12	0.11	-	0.15	0.14	0.13	0.12
Xq QUAD. AXIS REACTANCE	1.29	1.16	1.08	-	1.47	1.40	1.28	1.24
X"q QUAD. AXIS SUBTRANSIENT	0.18	0.16	0.15	-	0.18	0.17	0.16	0.15
X_L LEAKAGE REACTANCE	0.08	0.07	0.07	-	0.09	0.08	0.08	0.07
X_2 NEGATIVE SEQUENCE	0.13	0.12	0.11	-	0.16	0.15	0.13	0.13
X_0 ZERO SEQUENCE	0.08	0.07	0.07	-	0.10	0.09	0.08	0.08
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED							
T'd TRANSIENT TIME CONST.	0.038 s							
T"d SUB-TRANSTIME CONST.	0.012 s							
T'do O.C. FIELD TIME CONST.	1 s							
Ta ARMATURE TIME CONST.	0.01 s							
SHORT CIRCUIT RATIO	1/Xd							

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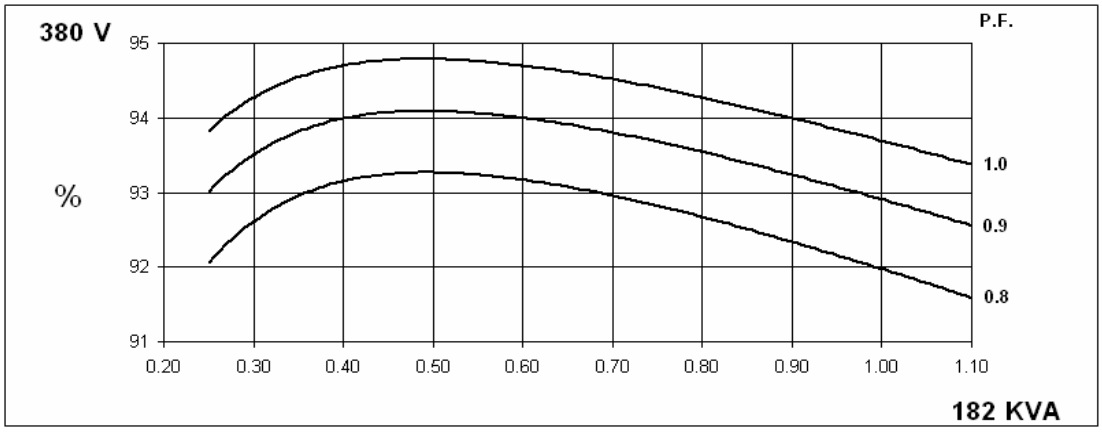
50 Hz

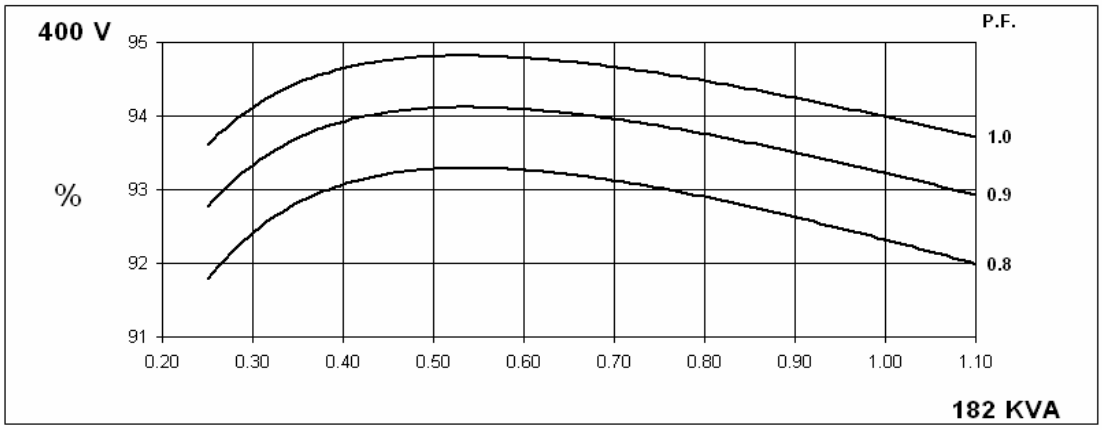
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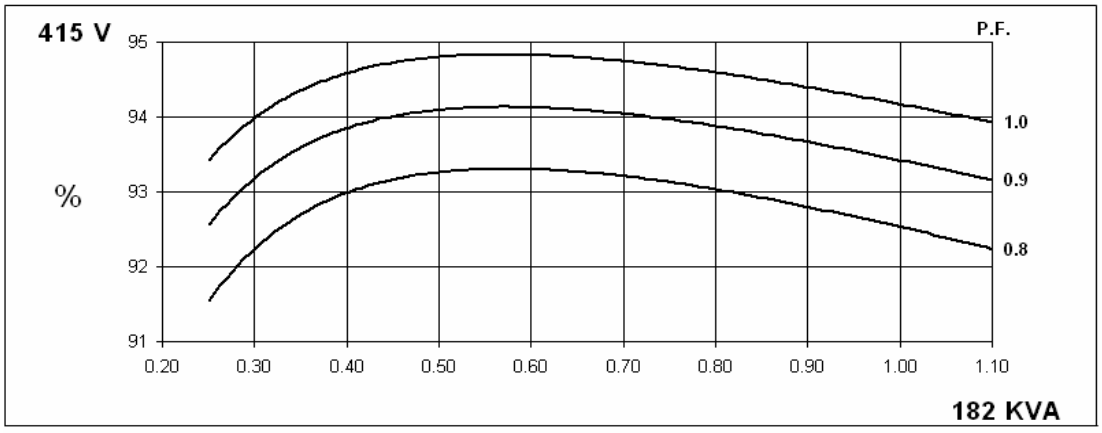
Winding 311

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THREE PHASE EFFICIENCY CURVES







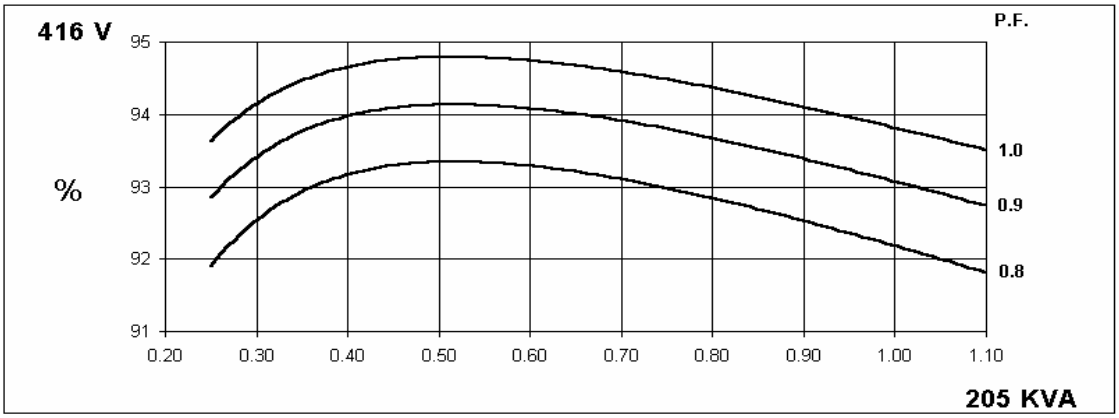
60 Hz

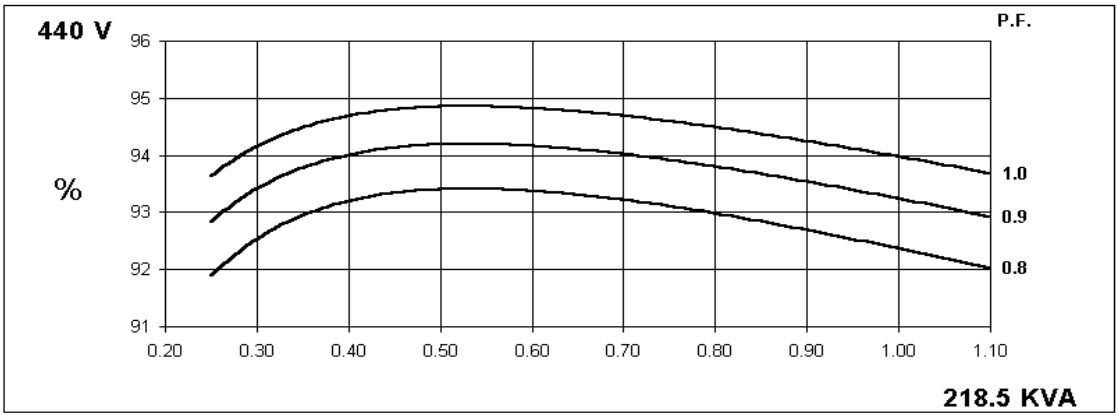
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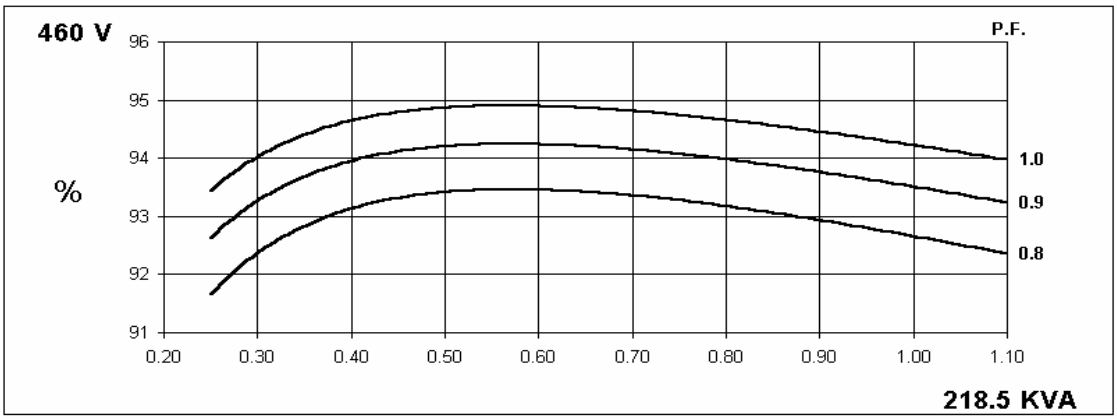
Winding 311

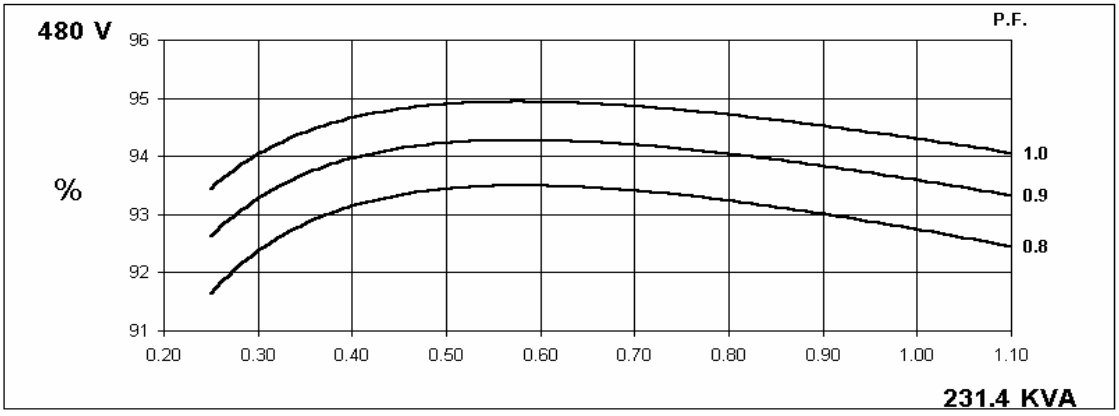
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THREE PHASE EFFICIENCY CURVES







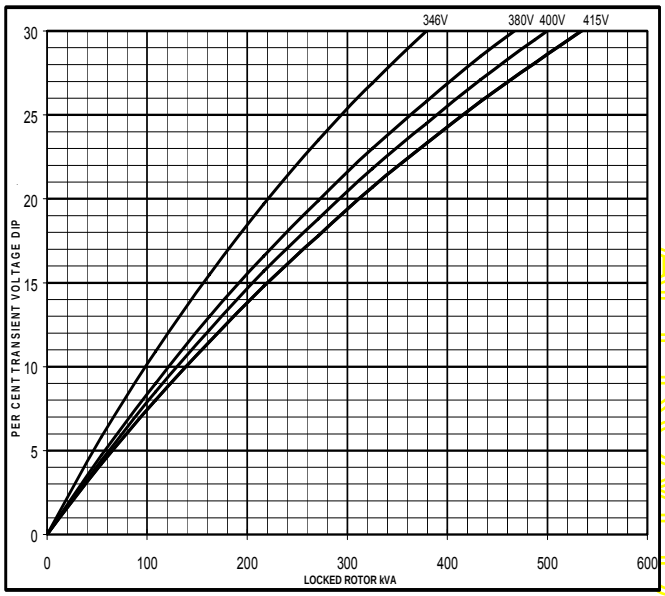


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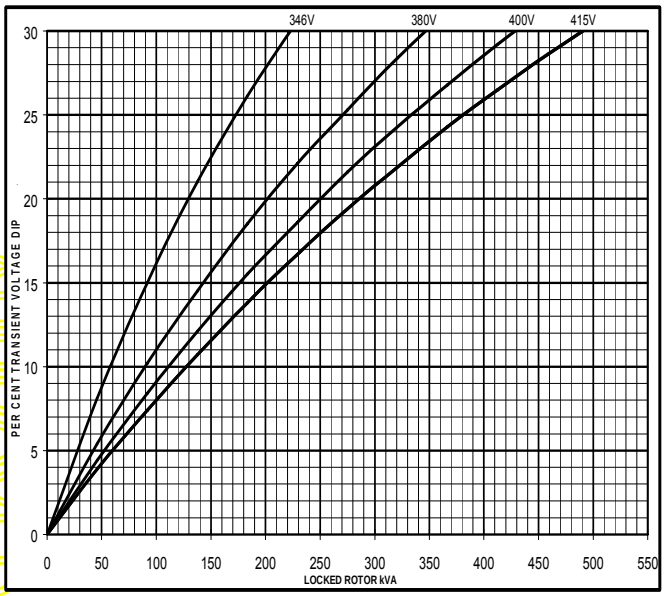
Locked Rotor Motor Starting Curve

50 Hz

MX



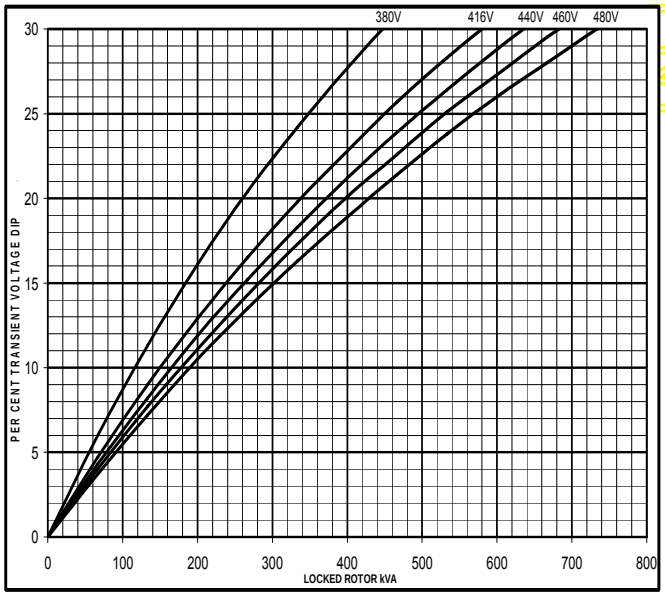
SX



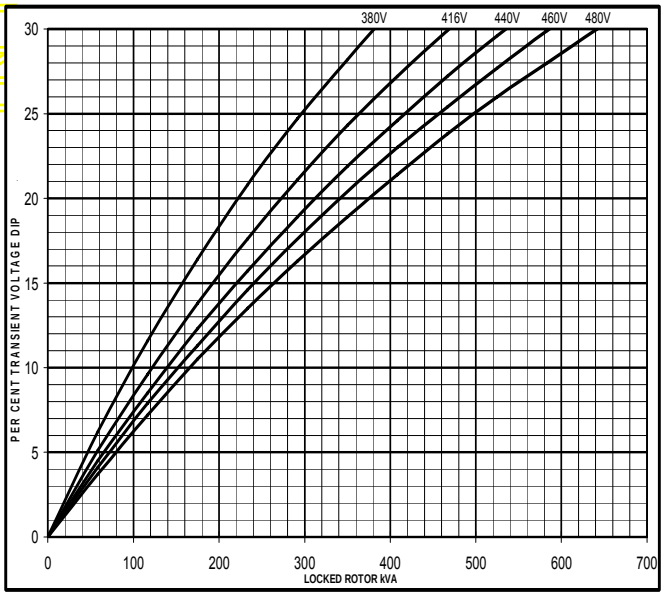
DO NOT COPY

60 Hz

MX

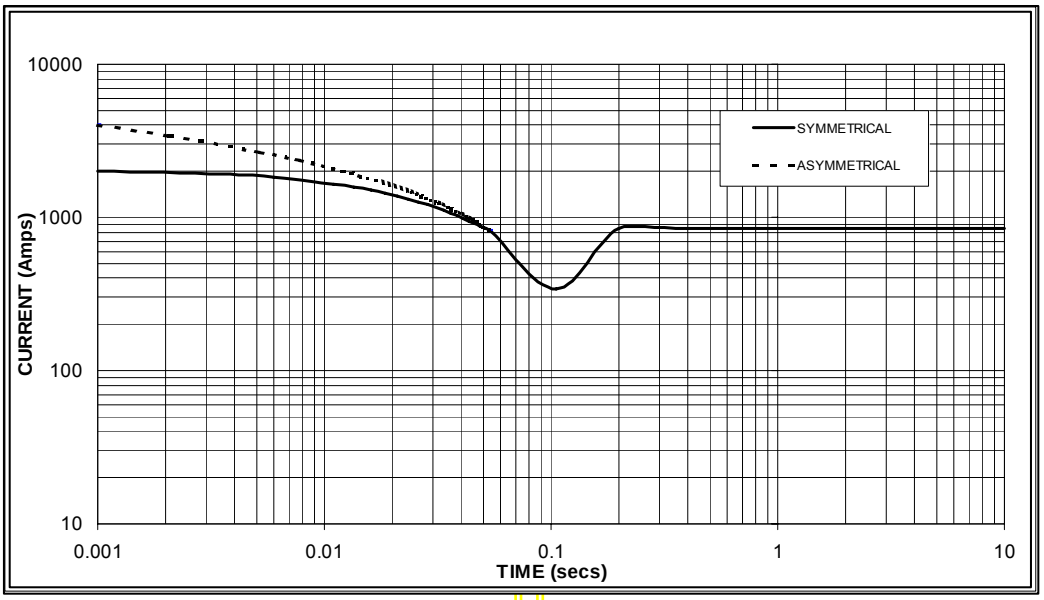


SX



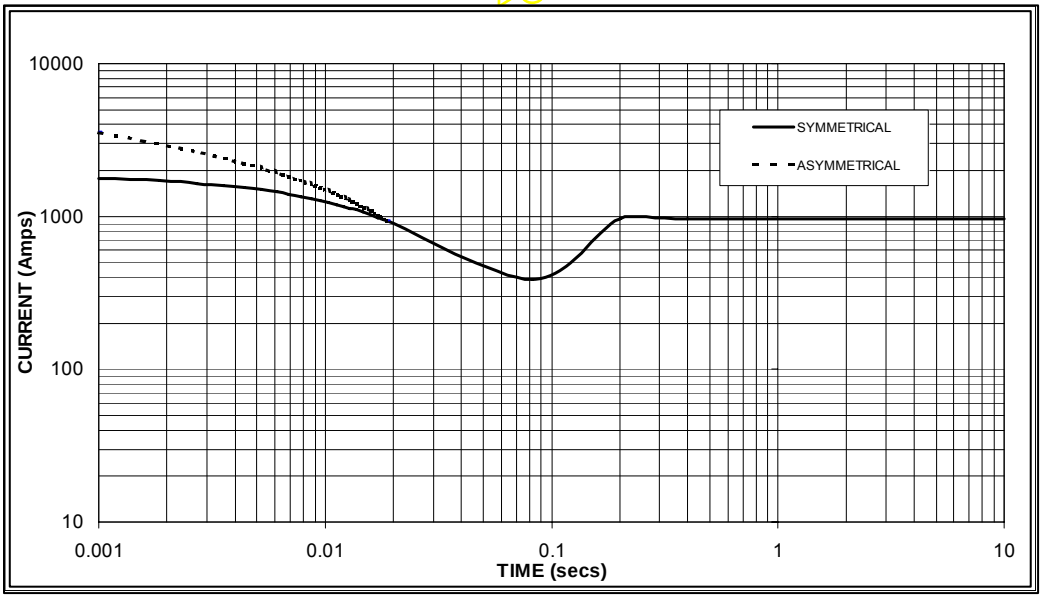
Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 850 Amps

60 Hz



Sustained Short Circuit = 970 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	X 1.00	416v	X 1.00
400v	X 1.07	440v	X 1.06
415v	X 1.12	460v	X 1.12
		480v	X 1.17

The sustained current value is constant irrespective of voltage level

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines. For other connection the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

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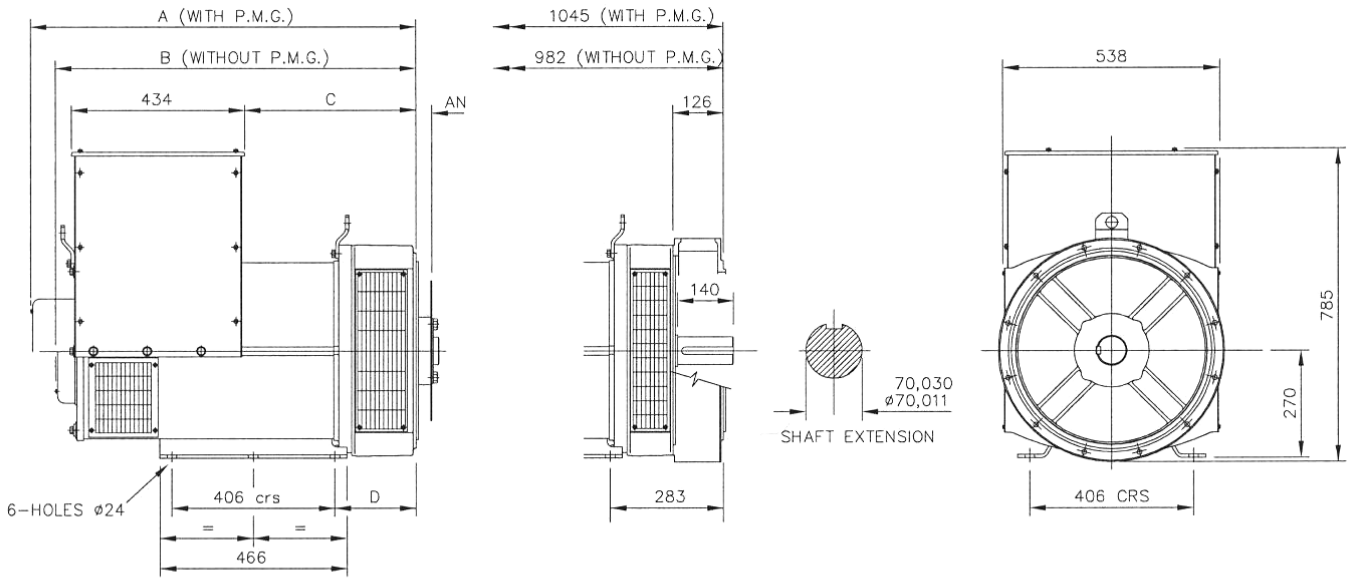
Winding 311 / 0.8 Power Factor

RATINGS

	Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	164.6	164.6	164.6	N/A	182.0	182.0	182.0	N/A	187.0	187.0	187.0	N/A	200.0	200.0	200.0	N/A
	kW	131.7	131.7	131.7	N/A	145.6	145.6	145.6	N/A	149.6	149.6	149.6	N/A	160.0	160.0	160.0	N/A
	Efficiency (%)	92.3	92.6	92.8	N/A	92.0	92.3	92.5	N/A	91.9	92.2	92.5	N/A	91.6	92.0	92.2	N/A
	kW Input	142.7	142.2	141.9	N/A	158.3	157.7	157.4	N/A	162.8	162.2	161.8	N/A	174.7	173.9	173.5	N/A
60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Series Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	192.8	199.0	199.0	212.2	205.0	218.5	218.5	231.4	213.0	228.8	228.8	250.0	218.5	234.0	234.0	253.3
	kW	154.2	159.2	159.2	169.8	164.0	174.8	174.8	185.1	170.4	183.0	183.0	200.0	174.8	187.2	187.2	202.6
	Efficiency (%)	92.4	92.7	92.9	93.0	92.2	92.4	92.7	92.7	92.0	92.2	92.5	92.5	91.9	92.1	92.4	92.5
	kW Input	166.9	171.7	171.4	182.5	177.9	189.2	188.6	199.7	185.2	198.5	197.9	216.2	190.2	203.3	202.6	219.1

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DIMENSIONS



SINGLE BEARING ADAPTORS				
ADAPTOR	A	B	C	D
SAE 1	978,3	915,3	439,3	216,3
SAE 2	964	901	425	202
SAE 3	964	901	425	202

COUPLING DISCS	
DISC	AN
SAE 10	53,98
SAE 11,5	39,68
SAE 14	25,40

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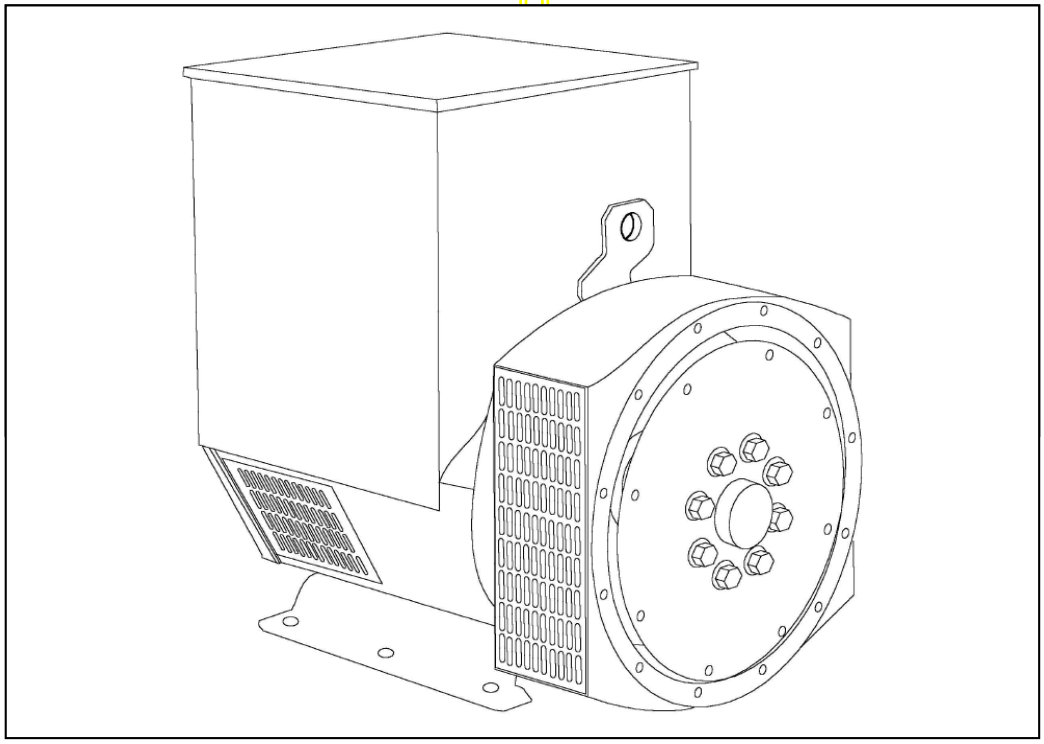
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STAMFORD®

UCI274G - Winding 17

Technical Data Sheet



SPECIFICATIONS & OPTIONS

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

SX460 AVR - STANDARD

With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

AS440 AVR

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.
If three-phase sensing is required with the PMG system the MX321 AVR must be used.
We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

APPROVED DOCUMENT

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 6 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5 C by which the operational ambient temperature exceeds 40 C.
Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

WINDING 17

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 5)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H	
PROTECTION	IP23	
RATED POWER FACTOR	0.8	
STATOR WINDING	DOUBLE LAYER CONCENTRIC	
WINDING PITCH	TWO THIRDS	
WINDING LEADS	12	
STATOR WDG. RESISTANCE	0.026 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED	
ROTOR WDG. RESISTANCE	1.69 Ohms at 22°C	
EXCITER STATOR RESISTANCE	20 Ohms at 22°C	
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C	
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others	
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%	
MAXIMUM OVERSPEED	2250 Rev/Min	
BEARING DRIVE END	BALL. 6315-2RS (ISO)	
BEARING NON-DRIVE END	BALL. 6310-2RS (ISO)	
	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	580 kg	598 kg
WEIGHT WOUND STATOR	225 kg	225 kg
WEIGHT WOUND ROTOR	210.35 kg	199.39 kg
WR² INERTIA	1.7674 kgm^2	1.7169 kgm^2
SHIPPING WEIGHTS in a crate	613 kg	630 kg
PACKING CRATE SIZE	123 x 67 x 103(cm)	123 x 67 x 103(cm)
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	0.617 m^3/sec 1308 cfm	
VOLTAGE SERIES STAR	600V	
VOLTAGE PARALLEL STAR	300V	
VOLTAGE SERIES DELTA	346V	
kVA BASE RATING FOR REACTANCE VALUES	225	
Xd DIR. AXIS SYNCHRONOUS	1.77	
X'd DIR. AXIS TRANSIENT	0.15	
X"d DIR. AXIS SUBTRANSIENT	0.10	
Xq QUAD. AXIS REACTANCE	1.07	
X"q QUAD. AXIS SUBTRANSIENT	0.13	
X_L LEAKAGE REACTANCE	0.07	
X_2 NEGATIVE SEQUENCE	0.11	
X_0 ZERO SEQUENCE	0.07	
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.	0.038s	
T"d SUB-TRANSTIME CONST.	0.012s	
T'do O.C. FIELD TIME CONST.	1.0s	
Ta ARMATURE TIME CONST.	0.01s	
SHORT CIRCUIT RATIO	1/Xd	

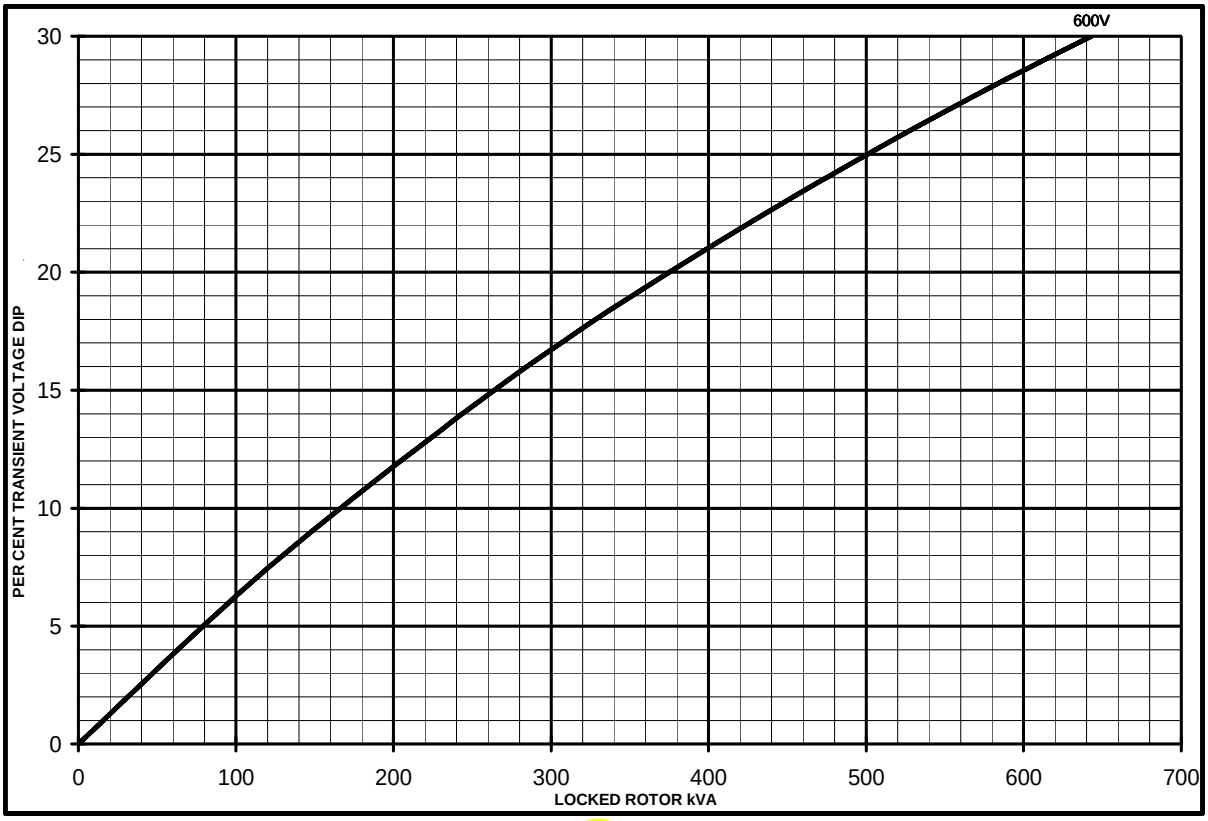
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UCI274G

Winding 17

SX

Locked Rotor Motor Starting Curves

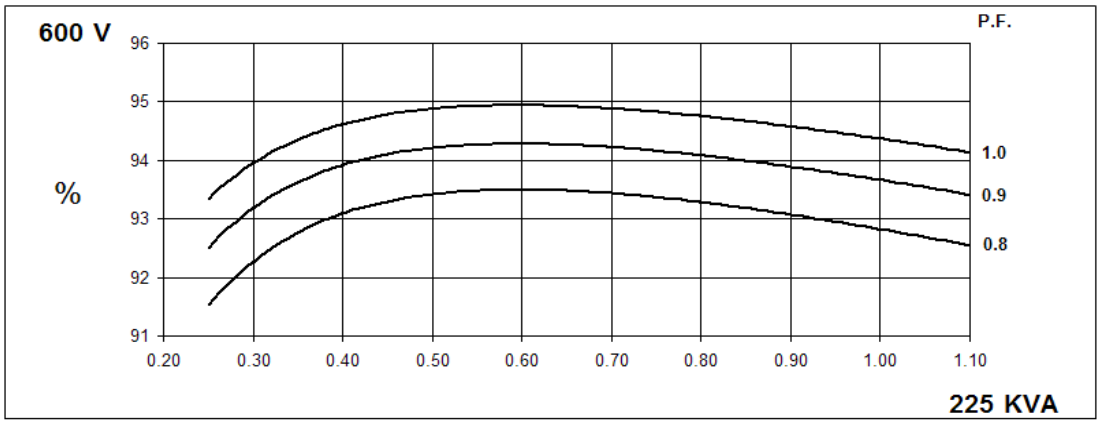


MX

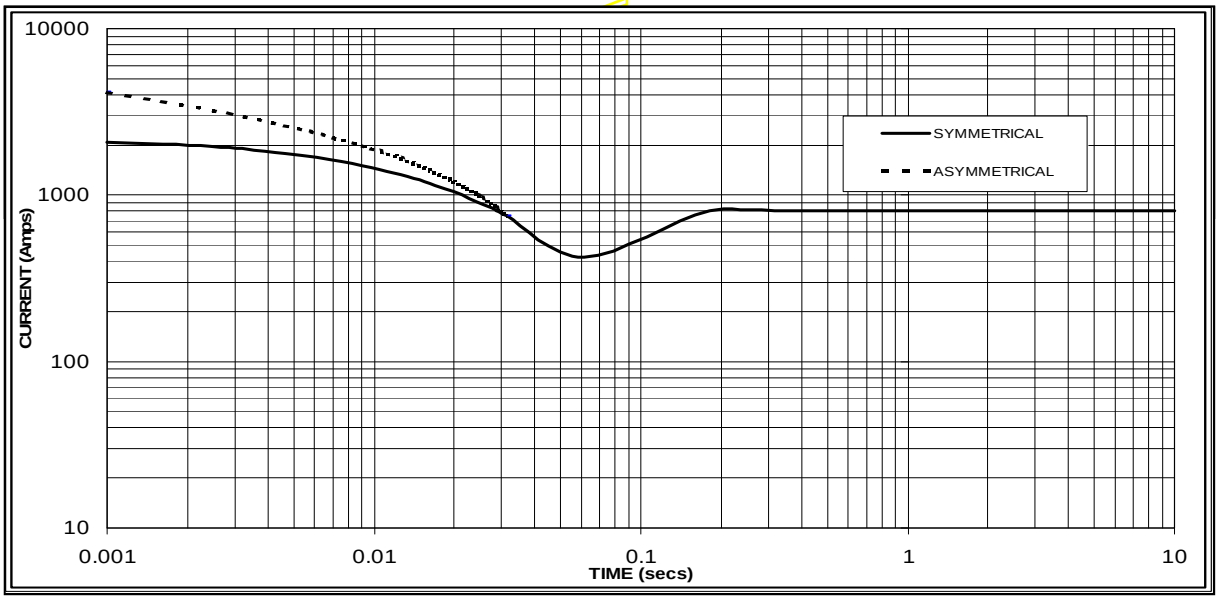


STAMFORD

THREE PHASE EFFICIENCY CURVES



Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.



Sustained Short Circuit = 800 Amps

Note
The following multiplication factor should be used to convert the values from curve for the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

UCI274G

Winding 17 / 0.8 Power Factor

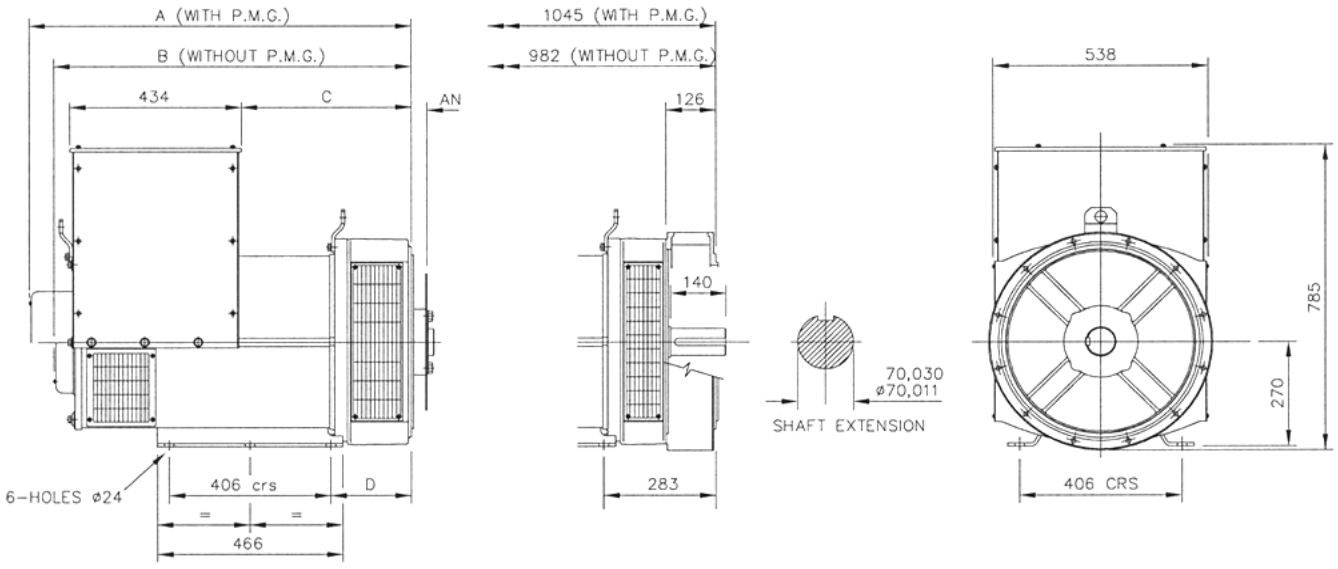
60Hz

RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Series Star (V)	600	600	600	600
Parallel Star (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	206.3	225.0	240.0	246.3
kW	165.0	180.0	192.0	197.0
Efficiency (%)	93.0	92.8	92.6	92.6
kW Input	177.4	193.9	207.3	212.9

APPROVED

DIMENSIONS



SINGLE BEARING ADAPTORS				
ADAPTOR	A	B	C	D
SAE 1	978,3	915,3	439,3	216,3
SAE 2	964	901	425	202
SAE 3	964	901	425	202

COUPLING DISCS	
DISC	AN
SAE 10	53,98
SAE 11,5	39,68
SAE 14	25,40

APPROVED DOCUMENT

STAMFORD

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DGC-2020 Digital Genset Controller







A highly advanced integrated genset control system, this device provides genset control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.

Features

- Generator metering (includes three-phase mains)
- Engine and generator protection: 27, 32R, 40Q, 59, 81O/U
- Optional enhanced generator protection: 47, 51, 78, and 81ROCOF
- Load sharing and generator sequencing (via LSM-2020 Load Share Module)
- Var sharing over Ethernet (via LSM-2020)
- BESTCOMS*Plus*® Software
  - Programming and setup
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable logic
  - USB communications
- Automatic transfer switch control
- Automatic synchronizer (optional)
- Exercise timer
- SAE J1939 engine ECU communications
- Automatic generator configuration detection
- Expandable functionality via add-on modules
  - LSM-2020 Load Share Module
  - CEM-2020 Contact Expansion Module
  - AEM-2020 Analog Expansion Module
- Multilingual capability
- Remote communications to Basler's RDP-110 (remote display panel)
- Sixteen programmable contact inputs
- Up to 15 contact outputs: 3 contacts rated for 30 Adc and up to 12 programmable contacts rated for 2 Adc

Visit www.basler.com for additional information.

Benefits

- Provides integrated engine-genset control, protection, and metering in a single package.
- The Offline Simulator, provided in BESTlogic™*Plus*, helps test and troubleshoot logic without the need for expensive hardware.
- Flexible programmable logic and programmable I/O make it easy to expand the DGC-2020's inputs and outputs with the CEM-2020 (Contact Expansion Module) and the AEM-2020 (Analog Expansion Module). This saves time and money by eliminating unnecessary external PLCs and control relaying.

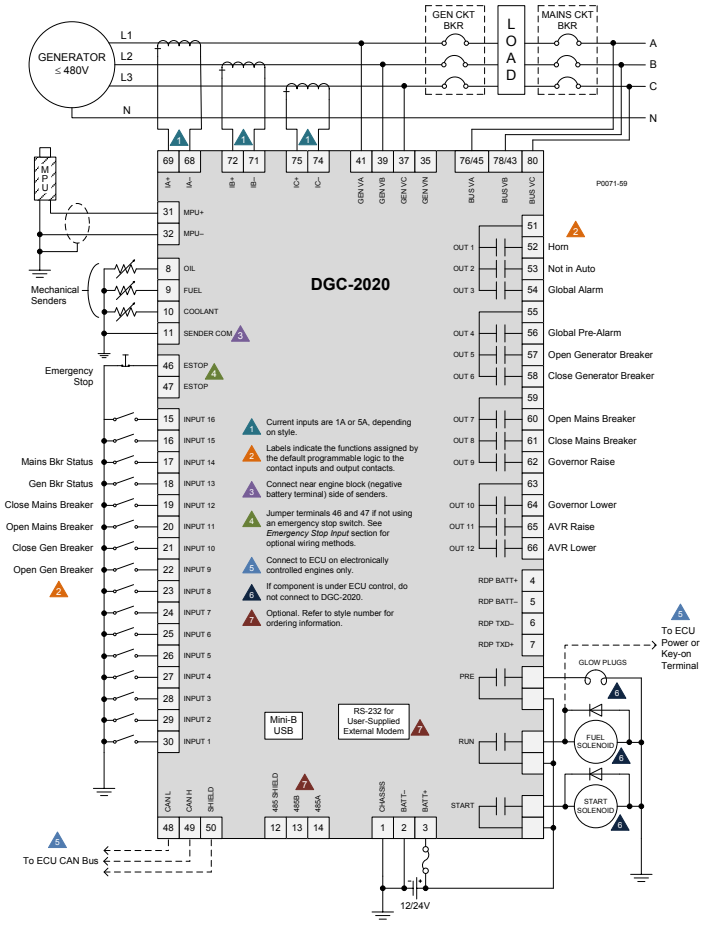


Figure 1 - DGC-2020 Connection Diagram for a Typical Application

Specifications

Power Supply

Nominal:	12 or 24 Vdc
Range:	6 to 32 Vdc
Battery Ride Through:	Starting at 10 Vdc, withstands cranking ride-through down to 0 V for 50 ms

Power Consumption

Sleep Mode:	5 W
Normal Operational Mode:	7.9 W
Maximum:	14.2 W

Current Sensing

1 A Sensing:	0.02 to 1.0 Aac, continuous 2 Aac for 1 second
5 A Sensing:	0.1 to 5.0 Aac, continuous 10 Aac for 1 second
Burden:	1 VA

Voltage Sensing

Range:	12 to 576 Vrms L-L
Frequency Range:	10 to 72 Hz for 50/60 Hz style, 10 to 480 Hz for 400 Hz style
Burden:	1 VA
One-second Rating:	720 Vrms

Contact Sensing

Contact Inputs (16):	Accepts normally open (N.O.), Dry Contacts, programmable
Emergency Stop:	Normally closed (N.C.), Dry Contact

Engine Speed Sensing

Magnetic Pickup:	
Voltage Range:	6 to 70 Vpp
Frequency Range:	32 to 10,000 Hz
Generator Frequency:	
Generator Voltage Range:	12 to 576 Vrms
Via ECU over J1939	

Resistive Senders

Fuel Level Sender:	0 to 250 Ω nominal
Coolant Temp Sender:	10 to 2,750 Ω nominal
Oil Pressure Sender:	0 to 250 Ω nominal

Output Contacts

Fuel Solenoid, Engine Crank, Pre-Start Relays Rating:	30 Adc at 28 Vdc-make, break, and carry
Programmable Relays:	Up to 12
Rating:	2 Adc at 28 Vdc-make, break, and carry

Protection

Generator:	27, 32R, 40Q, 59, 81O/U (standard) 47, 51, 78, 81 ROCOF (optional)
Engine:	Oil pressure, coolant temperature, overcrank, ECU-specific elements, and diagnostic reporting.

Agency Approvals

CSA certified, NFPA compliant, CE compliant, UL recognized (Hazardous Location certification available upon request), EAC certified

Communication

USB Port:	USB 2.0, Mini-B jack
RS-485 (optional):	9600 baud, 8 data bits, no parity
RDP-110 (optional):	4,000 ft (1,219 m) max wire length, 20 AWG (0.52 mm²) min wire size
Modem (optional):	DB-9 connector (male)
CAN bus:	250 kb/s communication rate, 1.5 to 3 Vdc differential bus

Environmental

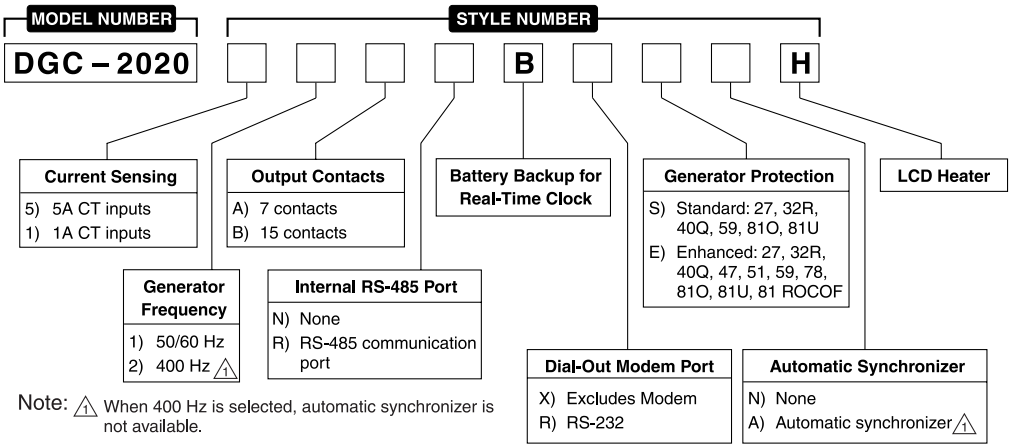
Operating Temp:	-40°C to 70°C (-40°F to 158°F)
Storage Temp:	-40°C to 85°C (-40°F to 185°F)
Humidity:	IEC 68-2-38
Salt Fog:	ASTM B 17-73, IEC 68-2-11
Ingress Protection:	IEC IP54 for front panel
Shock:	15 G in three perpendicular planes
Vibration:	
5 to 29 Hz:	1.5 G peak
29 to 52 Hz:	0.036″ (0.914 mm) double amplitude
52 to 500 Hz:	5 G peak

Physical

Weight:	4.4 lb (2 kg)
Dimensions (WxHxD):	11.77 x 8.27 x 2.69 inches (299 x 210 x 69 mm)

For complete specifications, download the instruction manual at www.basler.com.

Style Chart



Note: 1 When 400 Hz is selected, automatic synchronizer is not available.

Related Products

- BE1-11*g* Generator Protection System
  - A complete generator protection system.
- DECS-250 Digital Excitation Control System
  - Total control in a compact package provides precise voltage, var and power factor regulation, exceptional system response, and generator protection.

Accessories

- AEM-2020 Analog Expansion Module
  - Easily increases the functionality by seamlessly adding analog inputs and outputs.
- CEM-2020, CEM-2020H Contact Expansion Module
  - Each module adds 10 inputs and up to 24 outputs that are easily programmed through BESTCOMS*Plus*® for easy integration into the system.
- LSM-2020 Load Share Module
  - The simple-to-use LSM-2020 easily adds paralleling capabilities with little effort and expense.
- RDP-110 Remote Display Panel
  - Provides remote alarm and pre-alarm indication and annunciation of system status, easily meeting the annunciation requirements of NFPA-110 applications.

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Tmax-Molded Case Circuit Breakers

T4 250A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 8.07H x 4.13W x 4.07D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T4				
Continuous Current Rating		250A				
Number of Poles		3-4				
		N	**S**	**H**	**L**	**V**
AC						
240V		65	100	150	200	200
480V		25	35	65	100	150
600V		18	25	35	65	100
DC*						
500V	2 poles in series	25	35	50	65	100
600V	3 poles in series	16	25	35	50	65

*Thermo Magnetic Trip Only

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Plug-in
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMF thermo magnetic trip units, with fixed thermal and magnetic threshold (I3 = 10 x In);

TMD (up to 50 A) thermo magnetic trip units with adjustable thermal threshold (I1 = 0.7…1 x In) and fixed magnetic threshold (I3 = 10 x In).

TMA thermo magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit

Weight (lbs)	6.18

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

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Printed in USA, November, 2005

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T5 400A and 600A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches (400A Only)

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 8.07H x 5.51W x 4.07D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T5				
Continuous Current Rating		400-600A				
Number of Poles		3-4				
		N	**S**	**H**	**L**	**V**
AC						
240V		65	100	150	200	200
480V		25	35	65	100	150
600V		18	25	35	65	100
DC* (400 A only)						
500V	2 poles in series	25	35	50	65	100
600V	3 poles in series	16	25	35	50	65

*Thermo Magnetic Trip Only

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

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Mounting

Fixed
Plug-in
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermo magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit

Weight (lbs)	8.55

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

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T6 800A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions	3P Fixed Version	10.55H x 8.26W x 4.07D
Weight	20.9 (lbs)	

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– "Low Voltage Directives" (LVD) no. 73/23 EEC
– "Electromagnetic Compatibility Directive" (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T6			
Continuous Current Rating		800			
Number of Poles		3-4			
		N	**S**	**H**	**L**
AC					
	240V	65	100	200	200
	480V	35	50	65	100
	600V	20	25	35	42
DC*					
	500V 2 poles in series	35	35	50	65
	600V 3 poles in series	20	20	35	50

*Thermal Magnetic Trip Only

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermal magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P, and PR222DS/PD-A electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)

Publication LV113
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ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Digital Linear Chargers

Specifications

- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant
- UL listed to marine standard 1236
- 3 year warranty
- Replaces all existing current on-board chargers (excluding portables)
- No Price Increase
- Availability: November 2010



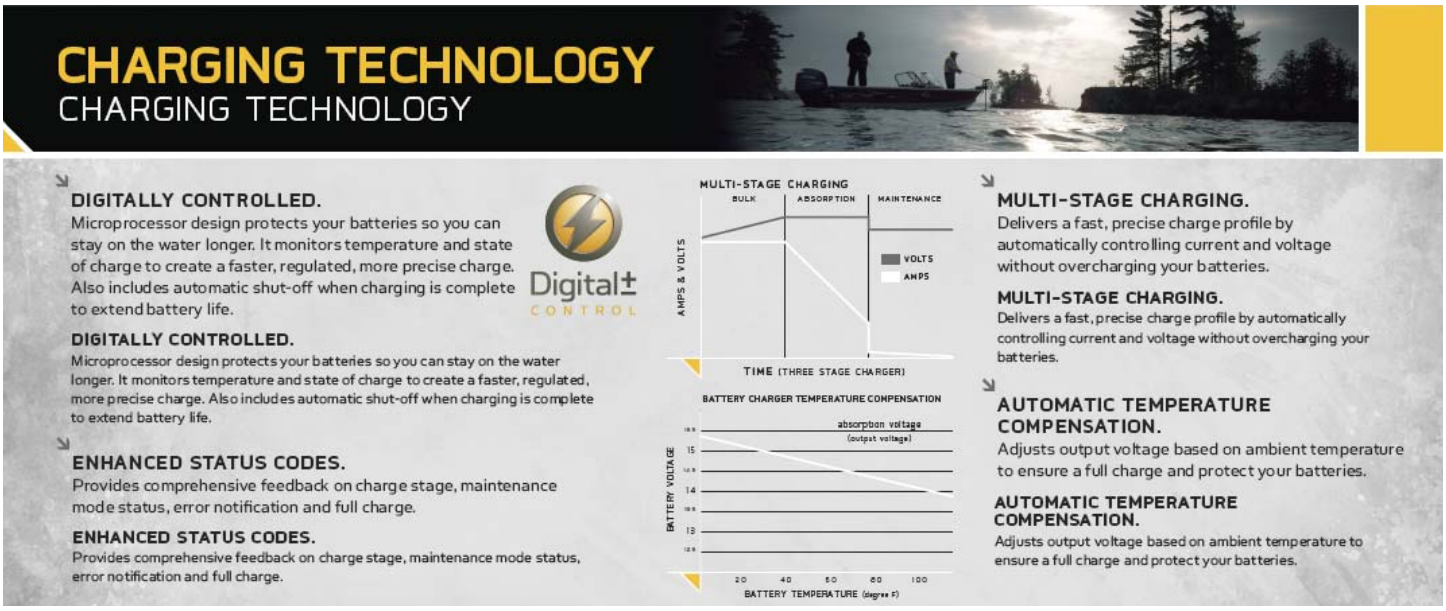
DIGITAL LINEAR ON-BOARD CHARGERS	
PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 amps)
1822305	MK-230D (2 bank x 15 amps)
1823455	MK-345D (3 bank x 15 amps)
1824605	MK-460D (4 bank x 15 amps)

Digital Linear Chargers

Specifications (cont.)

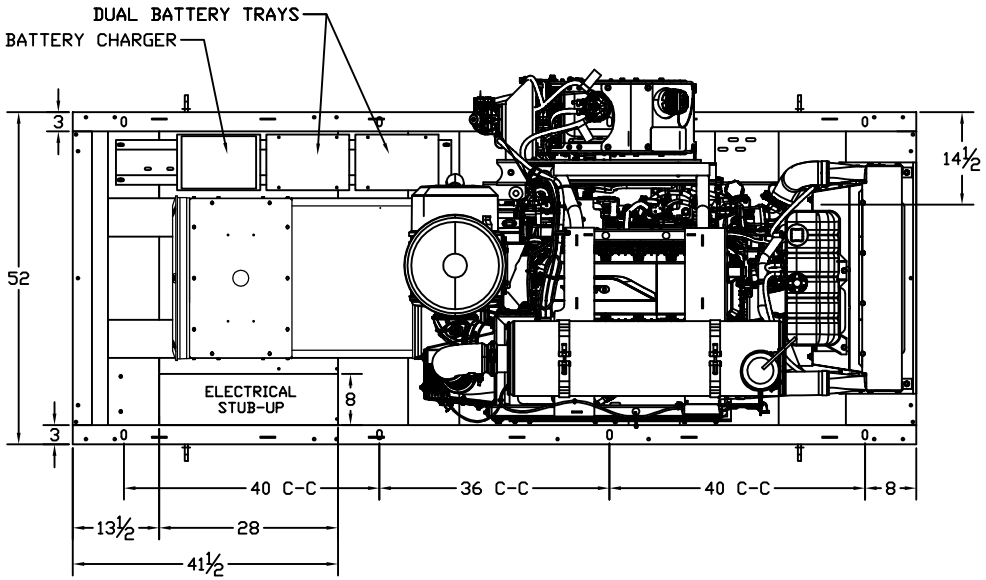
- New 4-color package design

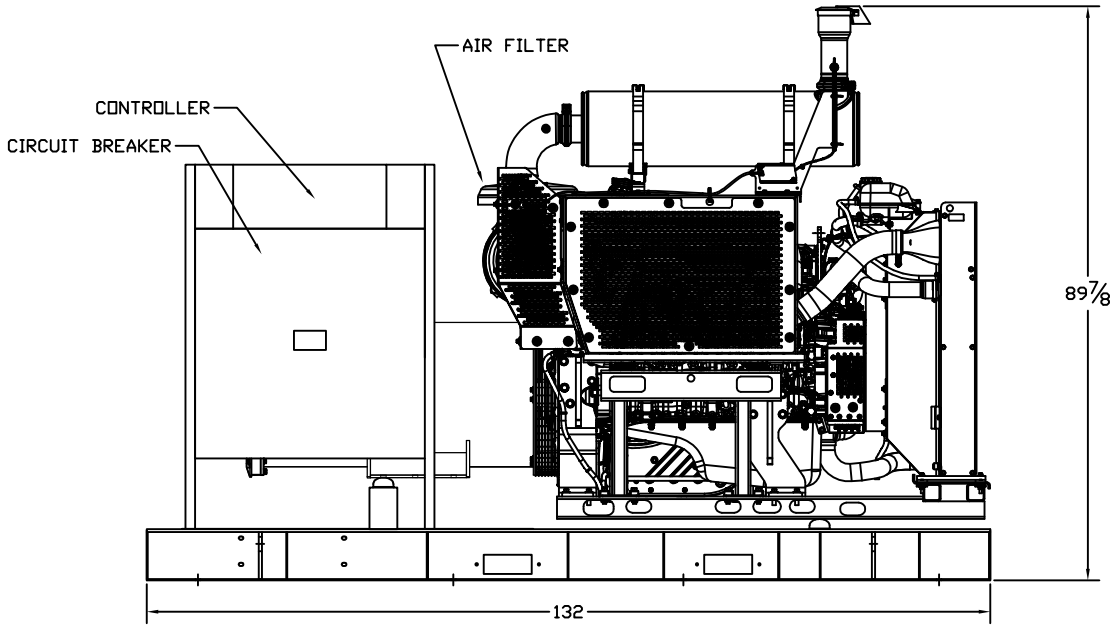




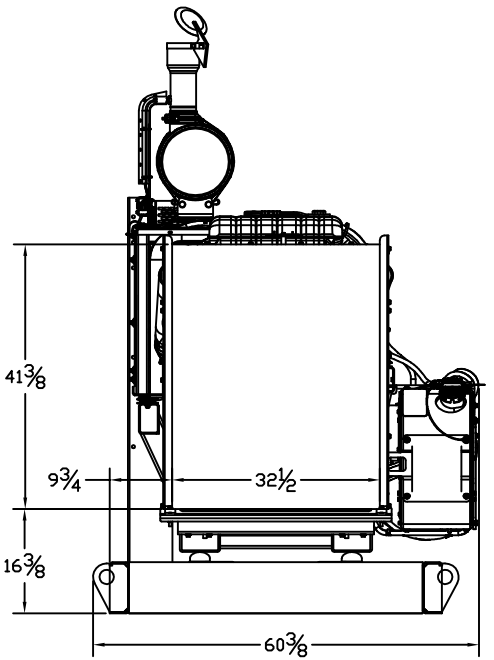
OUTLINE DIMENSIONS FOR T4D-1500 OPEN

TOP VIEW





RIGHT SIDE VIEW

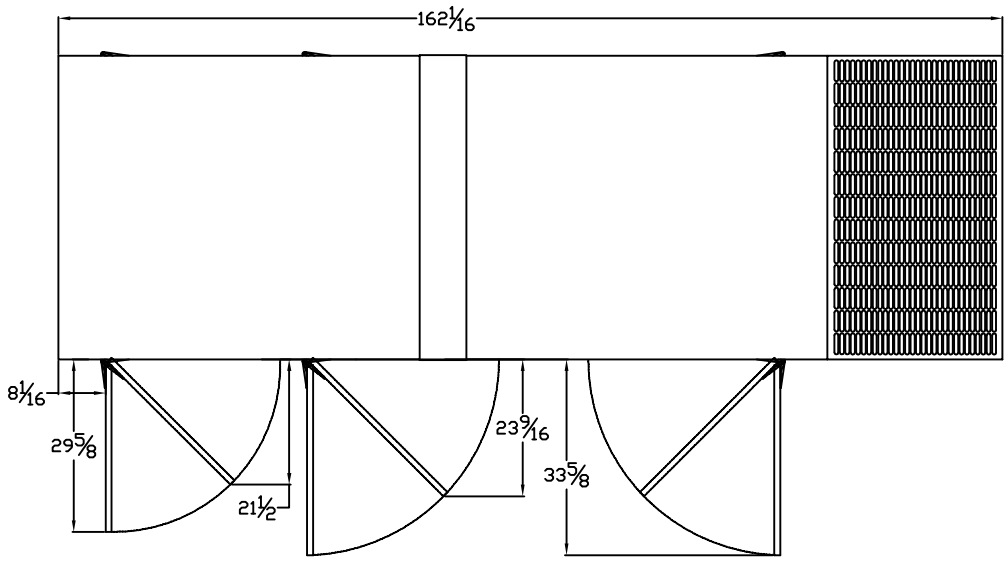


RADIATOR END VIEW

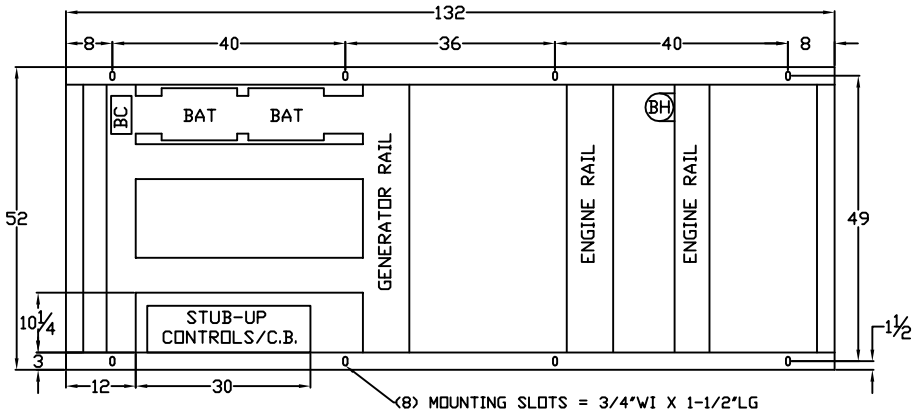
OUTLINE DIMENSIONS FOR T4D 100 - 200 KW LEVEL 2 ENCLOSURE
(HINGED DOORS)

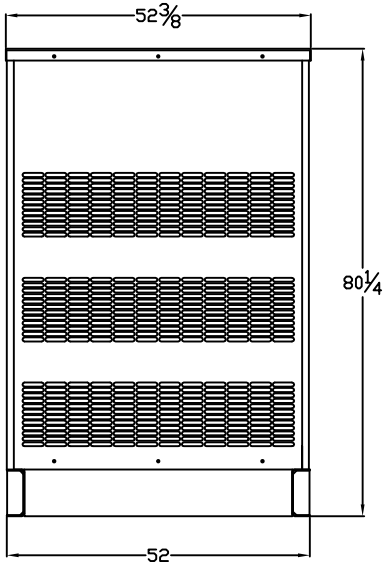
TOP VIEW

(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)

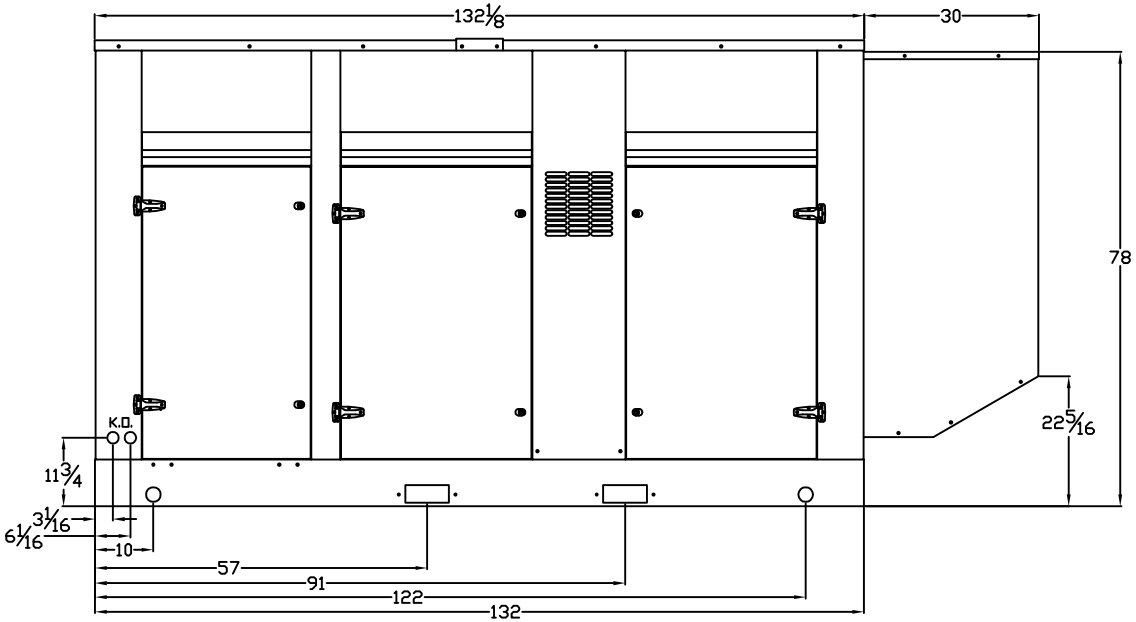


FRAME VIEW

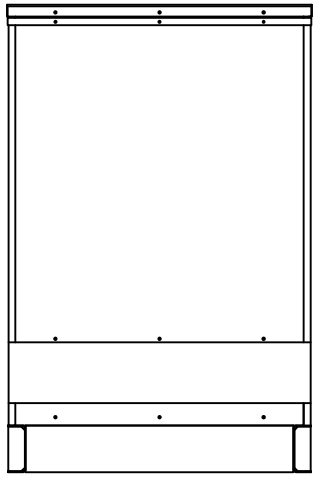




GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW

GILLETTE GENERATORS

LIQUID COOLED DIESEL ENGINE GENERATOR SET

60 HZ MODEL

T4D-3000

Model	HZ	STANDBY 130ºC RISE	PRIME 105ºC RISE
T4D-3000-60 HERTZ	60	300	300

All generator sets are USA prototype built and thoroughly tested. Production models are USA factory built and 100% load tested.

UL1446, UL508, UL142, UL498

NFPA 110, 99, 70, 37
All generator sets meet NFPA-110 Level 1, when equipped with the necessary accessories and installed per NFPA standards.

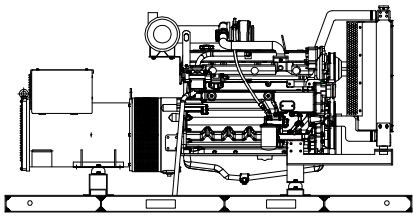
NEC 700, 701, 702, 708

NEMA ICS10, MG1, ICS6, AB1

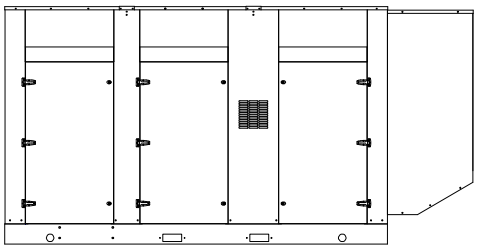
ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05

ASCE 7-05 & 7-10
All generator sets meet 180 MPH rating.

EPA 40CFR Part 60, 89, 1039, 1048, 1054, 1065, 1068



"OPEN" GEN-SET
There is no enclosure, so gen-set must be placed within a weather protected area, un-inhabited by humans or animals, with proper ventilation. Silencer not supplied, as installation requirements are not known. However, this item is available as optional equipment.



"LEVEL 2" HOUSED GEN-SET
Full aluminum weather protection and superior sound attenuation for specific low noise applications. Critical grade muffler is standard.

GENERATOR RATINGS

GENERATOR MODEL	VOLTAGE		PH	HZ	130ºC RISE STANDBY RATING		105ºC RISE PRIME RATING	
	L-N	L-L			KW/KVA	AMP	KW/KVA	AMP
T4D-3000-3-2	120	208	3	60	300/375	1042	300/375	1042
T4D-3000-3-3	120	240	3	60	300/375	903	300/375	903
T4D-3000-3-4	277	480	3	60	300/375	451	300/375	451
T4D-3000-3-5	127	220	3	60	300/375	985	300/375	985
T4D-3000-3-16	346	600	3	60	300/375	361	300/375	361

RATINGS: All three phase gen-sets are 12 lead windings, rated at .8 power factor. 130° C "STANDBY RATINGS" are strictly for gen-sets that are used for back-up emergency power to a failed normal utility power source. This standby rating allows varying loads, with no overload capability, for the entire duration of utility power outage. 105° C "PRIME RATINGS" are strictly for gen-sets that provide the prime source of electric power, where normal utility power is unavailable or unreliable. A 10% overload is allowed for a total of 1 hour, within every 12 hours of operation, on every PRIME RATED systems. All gen-set power ratings are based on temperature rise measured by resistance method as defined by MIL-STD 705C and IEEE STD 115, METHOD 6.4.4. All generators have class H (180°C) insulation system on both rotor and stator windings. All factory tests and KW/KVA charts shown above are based 130°C (standby), and 105°C (prime) R/R winding temperature, within a maximum 40°C ambient condition. Generators operated at standby power ratings must not exceed the temperature rise limitation for class H insulation system, as specified in NEMA MG1-22.40. Specifications & ratings are subject to change without prior notice.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-3000-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer ..... Stamford Generators
Model & Type ..... S4L1D-F311, 4 Pole, 12 Lead, Three Phase
..... S4L1D-E311, 4 Pole, 12 Lead, 480V, Three Phase
..... S4L1S-E17, 4 Pole, 12 Lead, 600V, Three Phase
Exciter ..... Brushless, shunt excited
Voltage Regulator ..... Solid State, HZ/Volts
Voltage Regulation ..... ½%, No load to full load
Frequency ..... 60 HZ
Frequency Regulation ..... ± ½% (1/2 cycle, no load to full load)
Unbalanced Load Capability ..... 100% of standby amps
One Step Load Acceptance ..... 100% of nameplate rating
Total Stator and Load Insulation ..... Class H, 180°C
Temperature Rise ..... 105°C R/R, prime rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V) ... 1500 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V-600V) 2300 kVA
Bearing ..... 1, Pre-lubed and sealed
Coupling ..... Direct flexible disc.
Total Harmonic Distortion ..... Max 3½% (MIL-STD705B)
Telephone Interference Factor ..... Max 50 (NEMA MG1-22)
Deviation Factor ..... Max 5% (MIL-STD 405B)
Alternator ..... Self ventilating and drip-proof
Ltd. Warranty Period ..... 24 Months from start-up date or
..... 1000 hours use, first to occur.

GENERATOR FEATURES

- World Renown Stamford Electric Generator having UL-1446 certification.
- Full generator protection with **Basler DGC-2020** controller, having UL-508 certification.
- Automatic voltage regulator with over-excitation, under-frequency compensation, under-speed protection, and EMI filtering. Entire solid-state board is encapsulated for moisture protection.
- Generator power ratings are based on temperature rise, measured by resistance method, as defined in MIL-STD 705C and IEEE STD 115, Method 6.4.4.
- Power ratings will not exceed temperature rise limitation for class H insulation as per NEMA MG1-22.40.
- Insulation resistance to ground, exceeds 1.5 meg-ohm.
- Stator receives 2000 V. hi-potential test on main windings, and rotor windings receive a 1500 V. hi-potential test, as per MIL-STD 705B.
- Full amortisseur windings with UL-1446 certification.
- Complete engine-generator torsional acceptance, confirmed during initial prototype testing.
- Full load testing on all engine-generator sets, before shipping.

ENGINE SPECIFICATIONS AND APPLICATIONS DATA

ENGINE

Manufacturer ..... VOLVO-PENTA
Model and Type ..... TAD1373VE, 4 cycle, liquid Cooled
Aspiration ..... Turbo After Cooler, H2O to Air
Charged Air Cooled System ..... H2O to Air
Cylinder Arrangement ..... 6 Cylinders, In-Line
Displacement Cu. In. (Liters) 780 (12.8)
Bore & Stroke in (Cm) ..... 5.16 x 6.22 (13.1 x 15.8)
Compression Ratio 17.8:1
Main Bearings ..... Tin Overlay with Babbit Backing
Cylinder Head ..... Cast Iron with overhead Cam
Pistons ..... Aluminum Alloy with Graphite Coating
Crankshaft ..... Induction Hardened, Heat Treated Forged
Valves ..... Heat Treated and Hardened Exhaust Valve
Governor ..... Electronic, EMS 2.2
Frequency Regulation ..... ± 1/4%
Air Cleaner ..... Dry, Replaceable Cartridge
Engine Speed ..... 1800 rpm
Max Power, bhp (kwm) Standby 469 (345)
BMEP: psi (MPa) Standby 340 (2.3)
Ltd. Warranty Period ..... 2 Year or 1000 hrs, first to occur

FUEL SYSTEM

Type ..... Diesel Fuel Oil (ASTM No. 2-D)
Combustion System ..... Direct Injection
Fuel Injection Pump ..... Electronic, Delphi E3
24 VDC Coolant heaters ..... Optional Equipment
Fuel Filter .... Yes with Water Separator

FUEL CONSUMPTION

GAL/HR (LITER/HR)	STANDBY	PRIME
100% LOAD	21.8 (82.7)	21.8 (82.7)
75% LOAD	16.6 (62.7)	16.6 (62.7)
50% LOAD	11.5 (43.5)	11.5 (43.5)

OIL SYSTEM

Type ..... Full Pressure
Oil Pan Capacity qt. (L) 31.6 (29.9)
Oil Pan Cap. W/ filter qt. (L) 38 (35.9)
Oil Filter ..... 3, Replaceable Cartridge type

ELECTRICAL SYSTEM

Ignition System ..... Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 110 amp/hr.

Recommended battery to -18°C (0° F): ....(2) 12 VDC, BCI# 31, Max. Dimensions: 14"lg x 6 3/4" wi x 10" hi, with standard round posts. Min output 1000 CCA. Battery tray (max. dim. at 15"lg x 7"wi). This model has (2) battery trays, (2) hold down straps, (2) sets of battery cables, and (1) battery charger. Installation of (2) 12VDC starting batteries connected in series for 24VDC output is required, with possible higher AMP/HR rating, as described above, if the normal environment temperature averages -13° F (-25°C) or cooler.

CERTIFICATIONS

All engines are EPA emissions certified. All non-emergency stationary diesel engines are Tier IV Final compliant.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-3000-60 HZ

COOLING SYSTEM

Type of System ..... Air to Air, Charged Air Cooler
Coolant Pump .....Pre-lubricated, self-sealing
Cooling Fan Type .....Pusher
Fan Diameter inches (cm).....35.1 (89)
Fan drive ratio..... 0.99:1
Ambient Capacity of Radiator °F (°C).....131 (55)
Engine Jacket Coolant Capacity gal. (L).....5.28 (20)
Radiator Coolant Capacity gal. (L) 11.7 (44)
Water Pump Capacity gpm (L/min)..... .....87.0 (329)
Heat Reject Coolant: Btu/min ....….10,123
Air to Air Heat Reject, BTU/min. .... ….5,346
Heat Radiated to Ambient, BTU/min .... ….3,415
Low Radiator Coolant Level Shutdown……..Standard
Note: Coolant temp. shut-down switch setting at 228°F (109°C) with 50/50 (water/antifreeze) mix.

COOLING AIR REQUIREMENTS

Combustion Air cfm (m^3/min) 1,646 (46.6)
Max Air Intake Restrictions:
Clean Air Cleaner, KPA (psi) 5 (1.5)
Radiator Cooling Air, SCFM (m^3/min)……....29,894 (846)

EXHAUST SYSTEM

Exhaust Outlet Size.....8"
Max. Back Pressure in KPA (in. H2O).....10 (40)
Exhaust Flow, at rated KW, CFM (m3/min)..... 4,347 (123)
Exhaust Temp, (Stack) °F (ºC) 932 (500)

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, SCR/Residential Silencer	98	83

Note: Open sets (no enclosure) have installed selective catalytic reduction/residential silencer system. Level 2 enclosure has installed selective catalytic reduction/residential silencer. Sound tests are averaged from several test points and taken at 23 ft. (7 m) from source of noise at normal operation.

DERATE GENERATOR FOR ALTITUDE

3% per 1000 ft. (305m) above 3000 ft. (914m) from sea level

DERATE GENERATOR FOR TEMPERATURE

2% per 10°F (5.6°C) above 104°F (40°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm)	132 (335)	186 (472)
Width in (cm)	52 (132)	72 (183)
Height in (cm)	65 (165)	94 (239)
Net Weight lbs (kg)	6327 (2870) ...	8097 (3673)
Ship Weight lbs (kg)	6602 (2995) ...	8462 (3839)

BASLER DGC-2020 DIGITAL MICROPROCESSOR CONTROLLER



Basler DGC-2020

The "**2020**" controller is a highly advanced integrated gen-set control system for single gen-set applications. This controller includes a backlit LCD display which continuously displays the status of the engine and generator at all times.

Basler "**DGC-2020"** includes: Generator metering (including three phase) • Engine – Generator protections including IEEE-[27] under voltage, [32] power, [40] loss of excitation, [59] over voltage, [81] over and under frequency, Exercise timer • SAE J1939 engine ECU communications • Expansion capabilities for both inputs and outputs with expansion • Remote communications through RS-485 to Basler's RDP110 remote Display panel • (16) programmable contact inputs • (15) programmable contact outputs- (3) for up to 30AmpDC and (12) for up to 2 Amp DC • Illuminated Text Display • Front panel menu scroll buttons • Front panel operation mode buttons for STOP, RUN and AUTO • Alarm Silence and Lamp Test buttons

This controller includes expansion features including, RS485 (using MODBUS), direct USB connection with PC, expansion optioned using BESTCOMSPlus for remote annunciation and remote relay interfacing for a distance of up to 3300FT. The controller software is freely downloadable from the internet and allows monitoring with direct USB cable, LAN, or by internet via the built in web interface.



Further expansion is available by adding the optional RDP-110 remote display panel module. This featured device will allow Four programmable LEDs (2) alarms and (2) pre-alarms • (17) alarms and pre-alarms displayed from Basler controller • audible alarm horn • lamp test and alarm silence buttons • RD100 local power supply inputs of either 12vdc or 24vdc • connects through Basler controller through RS-485 communications protocol • conduit box included for (2) mounting configurations- either surface mount or semi-flush mounting.

STANDARD FEATURES FOR MODEL T4D-3000-60 HZ

STANDARD FEATURES

CONTROL PANEL:

Basler DGC-2020 digital microprocessor with logic allows programming in the field. Controller has:

- STOP-MANUAL-AUTO modes and automatic engine shutdowns, signaled by full text LCD indicators:
- Low oil pressure
- High engine temp
- Low Radiator Level
- Three auxiliary alarms
- Battery fail alarm
- Engine fail to start
- Engine over speed
- Engine under speed
- Over & under voltage

Also included is tamper-proof engine hour meter

ENGINE:

Fuel filter • Full flow Oil filter • Air filter • Fuel pump • Oil pump • Solenoid type starter motor • Hi-temp radiator • Jacket water pump • Thermostat • Pusher fan and guard • Exhaust manifold • Electronic Governor • 24 VDC battery charging alternator • Flexible fuel and exhaust connectors • Vibration isolators • Open coolant recovery system with 50/50 water to anti-freeze mixture • flexible oil & radiator hose • Shut-down sensors for low oil pressure, high coolant temp., low coolant level, high ambient temp.

Design & specifications subject to change without prior notice. Dimensions shown are approximate. Contact Gillette for certified drawings. DO NOT USE DIMENSIONS FOR INSTALLATION PURPOSES.

AC GENERATOR SYSTEM:

AC generator • Shunt excited • Brushless design • Circuit Breaker installed and wired to gen-set • Direct connection to engine with flex disc • Class H, 180°C insulation • Self ventilated • Drip proof construction • UL Certified

VOLTAGE REGULATOR:

1% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

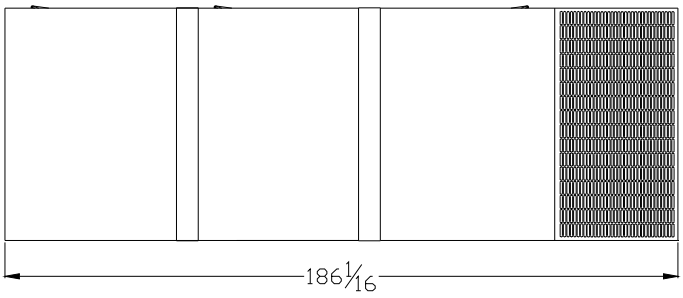
DC ELECTRICAL SYSTEM:

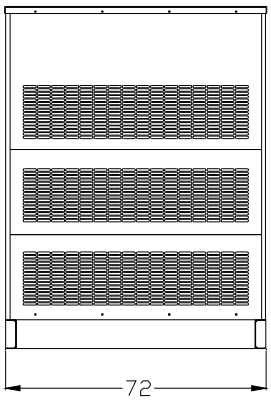
Battery trays • Battery cables • Battery hold down straps • 3-stage battery charger with float, absorption, & bulk automatic charge stages

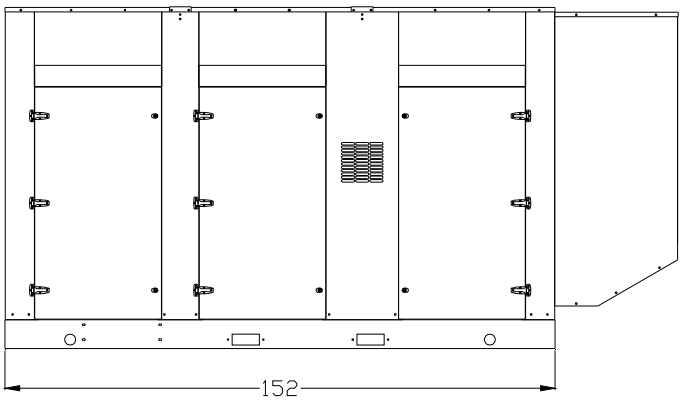
WEATHER / SOUNDPROOF ALUMINUM HOUSING:

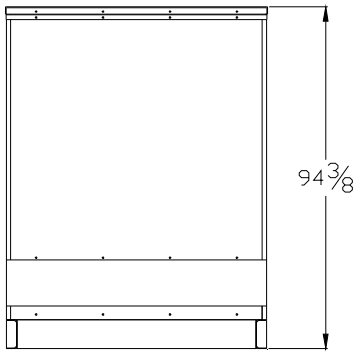
Corrosion Resistant Protection consisting of:

- (9) Heated and Agitated Wash Stages
- Zinc Phosphate Etching-Coating Stage
- Final Baked on Enamel Powder Coat
- 18/8 Stainless Steel Hardware





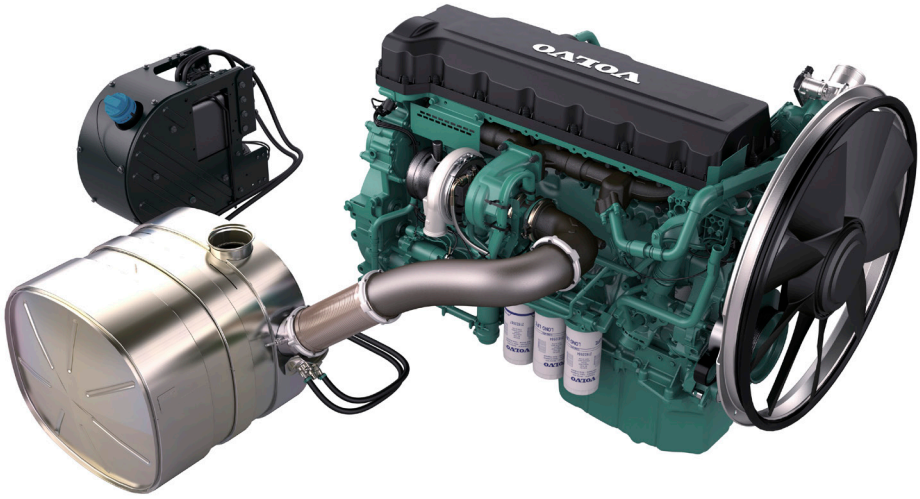




TAD1371-1375VE

12.78 litre, in-line 6 cylinder - 285, 315, 345, 375 & 405 kW

EU Stage IV / US EPA Tier 4 Final



TAD1371-1375VE is a powerful, reliable and economical off-road Diesel Engine range built on the Volvo Group in-line six concept.

Low cost of ownership

World class fuel efficiency combined with high uptime as well as low cost of ownership.

Compact & simple installation

As optional equipment all material needed in order to install the engine can be ordered from Volvo Penta. Installation guidelines as well as drawings and CAD models are easy to access. The result is an engine that is easy to install.

Durability & low noise

Long experince with base engine development reduces risk of downtime. Well-balanced to produce smooth operation with low noise.

Power & torque

Maximum power and torque available at low rpm. As a result noice as well as fuel consumption is very low. Useful engine speed for the TAD1371-1375VE is due to power and torque layout very flexible.

Low exhaust emission

Efficient injection as well as robust engine design in combination with optimised SCR technology and a light EGR contributes to excellent combustion and low fuel consumption.

Easy service & maintenance

Easily accessible service and maintenance points contribute to the ease of service of the engine. As optional equipment possible to remote mount filters and service points.

- **Proven and straight-forward design - built on Volvo Group technology**
- **Low cost of ownership and operation**
- **High power and torque already at low engine speed**
- **SCR and light EGR only - no DPF, DOC or regeneration**
- **Compact, simple installation and easy to service**
- **Similar engine footprint for all emission standards**
- **Wide range of optional equipment**

Technical description

Engine and block

- Cast iron cylinder block
- Wet, replaceable cylinder liners
- Replaceable valve guides and valve seats
- Overhead camshaft and four valves per cylinder

Lubrication system

- Full flow disposable spin-on oil filter, for extra high filtration
- Gear type lubricating oil pump, gear driven by the transmission
- Oil level sensor at startup

Fuel system

- Electronic high pressure unit injectors
- Fuel prefilter with water separator and water-in-fuel indicator / alarm
- Gear driven low-pressure fuel pump
- Fine fuel filter with manual feed pump and fuel pressure switch

Cooling system

- Available as power pack or base engine.
- Belt driven coolant pump with high degree of efficiency

Turbo charger

- Electronically controlled Waste-gate

Electrical system

- Engine Management System (EMS) 2.3, an electronically controlled processing system which optimizes engine performance. It also includes advanced features for diagnostics and fault tracing.
- The instruments and controls connect to the engine via the CAN SAE J1939 interface. Options available for engine control equipment.

Exhaust aftertreatment system

- SCR and light EGR only
- Airless urea injection
- Wide range of options available, including different sized AdBlue® / DEF tanks (also possible for OEM to design own tank).
- AdBlue/DEF Quality Level Temperature Sensor for US Market

VOLVO PENTA

TAD1371-1375VE

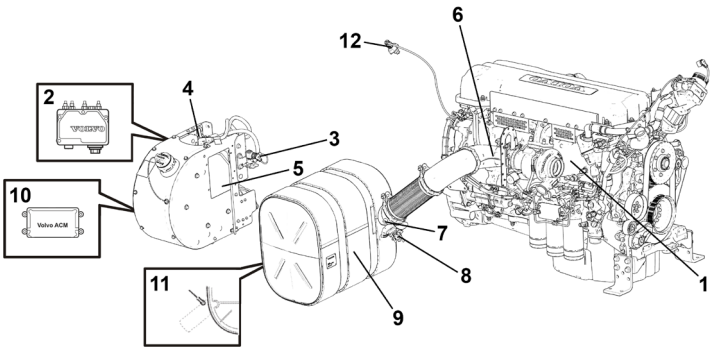
Technical data

Engine designation	TAD1371-1375VE
Configuration and no. of cylinders	in-line 6
Displacement, l (in³)	12.78 (780)
Method of operation	4-stroke
Direction of rotation (viewed towards flywheel)	anti-clockwise
Bore, mm (in.)	131 (5.16)
Stroke, mm (in.)	158 (6.22)
Compression ratio	17.8:1
Dry weight, engine only, kg (lb)	1267(2793)

Engine	kW	Hp	rpm	Max Nm
TAD1371VE	285	388	1900	1965
TAD1372VE	315	428	1900	2175
TAD1373VE	345	469	1900	2380
TAD1374VE	375	510	1900	2595
TAD1375VE	405	551	1900	2650

Main components, Principal layout

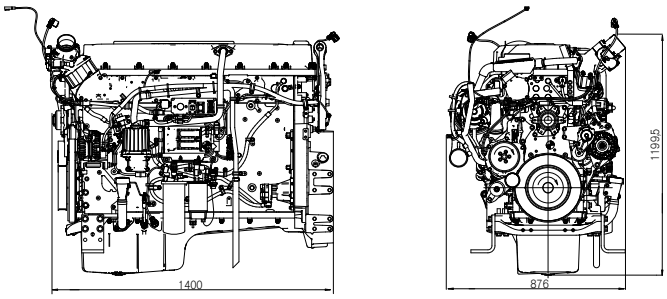
The illustration shows the main components of the aftertreatment system and its piping connections.



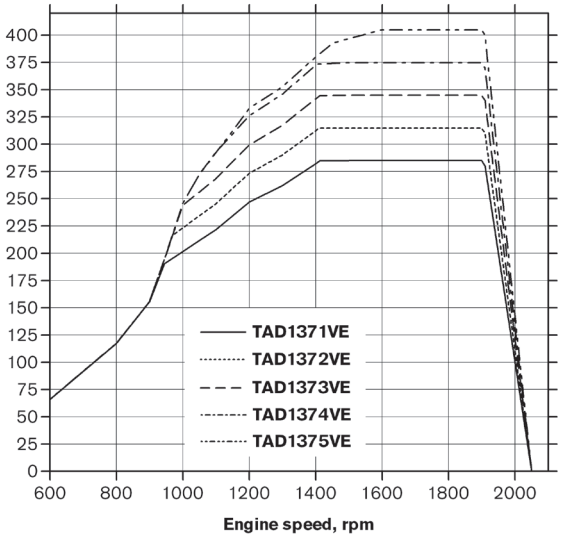
1. Engine
2. Pump Unit (PU)
3. Solenoid Valve, heating/cooling
4. AdBlue/DEF Level Temperature Sensor for EU Market
AdBlue/DEF Quality Level Temperature Sensor for US Market
5. AdBlue/DEF Solution Tank
6. NOx Sensor
7. Temperature Sensor Exhaust
8. Dosage Valve (DV)
9. Muffler with Catalytic Converter
10. Aftertreatment Control Module (ACM)
11. NOx Sensor
12. Temperature Sensor Air

Dimensions

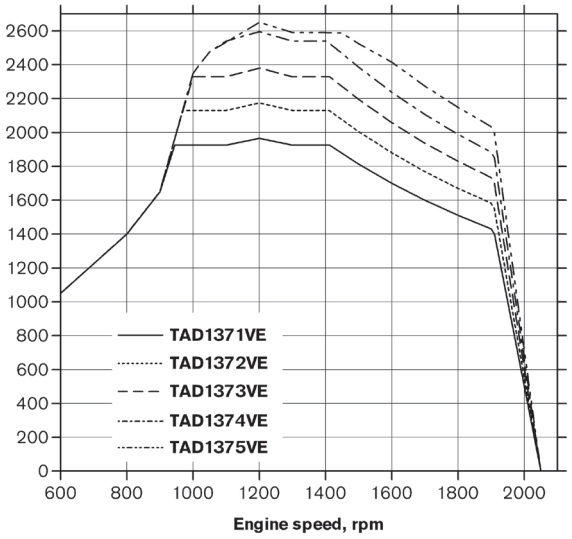
Not for installation. Dimensions in mm.



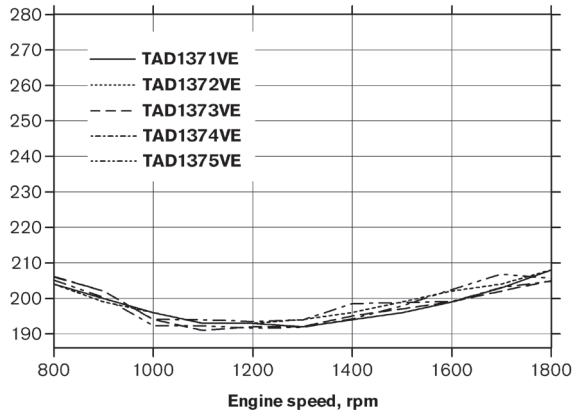
Power, kW



Torque, Nm



Fuel consumption, g/kWh



Power standards
The engine performance corresponds to ISO 3046, BS 5514 and DIN 6271. The technical data applies to an engine without cooling fan and operating on a fuel with calorific value of 42.7 MJ/kg (18360 BTU/lb) and a density of 0.84 kg/litre (7.01 lb/US gal, 8.42 lb/Imp gal), also where this involves a deviation from the standards.

Additional information
For additional information, please contact your Volvo Penta representative or visit www.volvopenta.com.

Not all models, standard equipment and accessories are available in all countries. All specifications are subject to change without notice. The engine illustrated may not be entirely identical to production standard engines.

VOLVO PENTA
AB Volvo Penta
SE-405 08 Göteborg, Sweden
www.volvopenta.com

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Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with ⚠ are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalities as described in the Clean Air Act.

General

In-line four stroke diesel engine with direct injection. Rotation direction, counterclockwise viewed towards flywheel

Number of cylinders			6
Displacement, total		liters in^3	12,78 780
Firing order			1-5-3-6-2-4
Bore		mm in	131 5,16
Stroke		mm in	158 6,22
Compression ratio			17,8:1
Wet weight	Engine only (Estimated) (excl after treatment comp.)	kg lb	1325 2921
	Power pac	kg lb	1790 3946

Performance				**rpm**	**1200**	**1500**	**1800**	**1900**
IFN Power 345 kW		without fan		kW hp	299 407	345 469	345 469	345 469
		with fan 890 mm		kW hp	291 396	333 453	325 442	321 437
Torque at:		IFN Power		Nm lbf ft	2380 1755	2196 1620	1830 1350	1734 1279
Max torque at engine speed		rpm	1200 rpm	Nm lbf ft	2380 1755			
Power tolerance				%	±2			
Mean piston speed				m/s ft/sec	6,3 20,7	7,9 25,9	9,5 31,1	10,0 32,8
Effective mean pressure at:		IFN Power		MPa psi	2,34 339	2,16 313	1,80 261	1,71 247
Max combustion pressure at:		IFN Power		MPa psi	16,7 2422	16,9 2451	15,6 2262	15 2175
Total mass moment of inertia, J (mR^2) (not including flywheel)				kgm^2 $lbft^2$	1,143 27,1			
Friction Power				kW hp	21 29	31 42	45 61	51 69
Derating see Technical Diagrams								

Engine brake performance (only engines with VCB)		rpm	1200	1500	1900	2200
Brake power:	without fan	kW	70	128	240	283
		hp	95	174	326	385
Brake torque:	without fan	Nm	557	815	1206	1228
		lbf ft	411	601	890	906
Engine speed range for VCB activation:		rpm	1000-2200			
Min engine speed with VCB still active:		rpm	900			
Min oil temperature for VCB activation:		°C	55			

Cold start performance

*Cold start limit temperature	without starting aid	°C °F	-15 5	
	with manifold heater 3 kW	°C °F	-25 -13	
	with manifold heater 3 kW and block heater	°C °F	-30 -22	
*Specify oil and fuel quality	T>-15°C Oil VDS3 or VDS4 15W/40 T<-15°C Oil VDS3 or VDS4 5W/40			
Heater type	Make	Power kW	Engaged hours (-30°C)	Cooling water temp engine block
Self circulating	Volvo 21578298	2	12	-1°C 30°F

* See also general section in the sales guide

Lubrication system

Lubricating oil consumption (average)			Vol%	0,02
Oil system capacity including filters			liter US gal	36 9,51
Oil pan capacity: (both variants)		Max	liter US gal	30 7,93
		Min	liter US gal	19 5,02
Oil change intervals/specifications	VDS3		h	1000
	VDS4		h	1000
Engine angularity limits:		front up	°	11
		front down	°	11
		side tilt	°	11
Oil pressure at rated speed			kPa psi	300 - 650 44 - 94

Lubrication system

Lubrication oil temperature in sump:	max	°C °F	130 266
Oil filter filtration efficiency (in accordance with ISO 4548-12)	99%	µ	38
	50%	µ	14

Fuel system

System supply flow at max. Speed		liter/h US gal/h	130 34,3
Fuel supply line max. restriction (measured at fuel inlet connection)		kPa psi	30 4,4
Fuel supply line max. pressure, during engine stand still (meassured at fuel inlet connection)		kPa psi	165 23,9
Fuel supply line min. pressure, during engine stand still (meassured at fuel inlet connection)		kPa psi	-125 -18,1
System return flow at max. Speed		liter/h US gal/h	30,0 7,9
Fuel return line max. restriction (measured at fuel return connection)		kPa psi	20 2,9
Max. allowable inlet fuel temp (Measured at fuel inlet connection)		°C °F	60 140
Prefilter / Water separator micron size		µ	10
Fuel filter filtration efficiency	96%	µ	6
	75%	µ	4
Governor type/make, standard		Volvo/EMS2.3	
Specific UREA consumption in Nonroad Transient Cycle (NRTC)		Vol%	4,9
Fuel to conform to			Fuel equal to or better than EN590:2009 or ASTM D975-09 and Max sulphur 15ppm

Intake and exhaust system		**rpm**	**1200**	**1500**	**1800**	**1900**
Charge air consumption at: (+25°C and 100kPa)	IFN Power	m³/min cfm	20,0 706	25,0 883	26 918	27 954
⚠ **See front page for important information** Max allowable air intake restriction including piping		kPa psi		6 0,9		
Heat rejection to exhaust at:	IFN Power	kW BTU/min	201 11431	250 14217	270 15355	278 15810
Exhaust gas temperature after turbine at:	IFN Power	°C °F	445 833	455 851	465 869	491 916
⚠ **See front page for important information** Max allowable back pressure in exhaust line (after turbine) Pipe dimension Ø: 125 mm		kPa psi	13 1,9	17 2,5	18 2,6	19 2,8
⚠ **See front page for important information** Max allowable temperature drop between turbine and SCR muffler inlet.		Δ°C Δ°F	10 18	10 18	10 18	10 18
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)		kPa psi	9 1,3	10 1,5	10 1,5	11 1,6
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	IFN Power	m³/min cfm	47,0 1660	56,0 1978	59 2084	61 2154

Cooling system			rpm	1200	1500	1800	1900
Heat rejection radiation from engine at:		IFN Power	kW	7,6	8,1	8,4	8,7
			BTU/min	432	461	478	495
Heat rejection to coolant at:		IFN Power	kW	124	143	155	161
			BTU/min	7052	8132	8815	9156
Coolant			Yellow Volvo Coolant Solution (VCS)				
Radiator cooling system type				Closed circuit			
Standard radiator core area			m²	0,8			
			foot²	8,61			
Fan diameter	890 mm		mm	890			
			in	35,04			
Fan power consumption	890 mm		kW	4,0	6,0	10,0	12,0
			hp	5	8	14	16
Fan drive ratio	fan Ø890			0,84:1 ccw			
Coolant capacity:	engine		liter	20			
			US gal	5,3			
	std. 0,8m² radiator with hoses		liter	24			
			US gal	6,3			
Coolant pump			drive/ratio	belt/1,41:1 cw			
Coolant flow with standard system			l/s	3,7	4,7	5,7	6
			US gal/s	1,0	1,2	1,5	1,6
Minimum coolant flow			l/s	3,2	4,2	5,5	5,5
			US gal/s	0,8	1,1	1,5	1,5
Maximum outer circuit restriction incl. piping			kPa	65,0			
			psi	9,4			
Thermostat:		start to open	°C	82			
			°F	180			
		fully open	°C	92			
			°F	198			
Maximum static pressure head (expansion tank height + pressure cap setting)			kPa	100			
			psi	14,5			
Minimum static pressure head (expansion tank height + pressure cap setting)			kPa	70			
			psi	10,2			
Standard pressure cap setting			kPa	75			
			psi	10,9			
Maximum top tank temperature			°C	107			
			°F	225			
Recommended Draw down capacity. The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still are functioning			liter	2			
			US gal	0,5			

Charge air cooler system		rpm	1200	1500	1800	1900
Heat rejection to charge air cooler	IFN Power	kW	54	63	64	61
		BTU/min	3071	3583	3640	3469
Charge air mass flow	IFN Power	kg/s	0,41	0,5	0,52	0,52
Charge air inlet temp.	IFN Power	°C	175	177	172	166
(Charge air temp after turbo compressor)		°F	347	351	342	331
⚠ **See front page for important information** Max allowable Charge air outlet temp.		°C	45	50	50	50
(Charge air temp after charge air cooler)		°F	113	122	122	122
⚠ **See front page for important information** Maximum pressure drop over charge air cooler incl. piping		kPa	12			
		psi	1,74			
Charge air pressure		kPa	209	207	179	166
(After charge air cooler)		psi	30,31	30,02	25,96	24,08
Standard charge air cooler core area		m²	0,8			
		foot²	8,61			

Cooling performance: 0.8 m² radiator and pull 890 fan

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

Engine speed	Engine power	Air on temp		Air flow		External restriction	
	kW						
rpm	hp	°C	°F	m^3/s	ft^3/s	Pa	psi
1900	345	58	136	6,4	226,0	247	0,036
0,84	469	60	140	6,9	243,7	125	0,018
		62	144	7,3	257,8	0	

Cooling performance: 0.8 m² radiator and push 890 fan

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

Engine speed	Engine power	Air on temp		Air flow		External restriction	
	kW						
rpm	hp	°C	°F	m^3/s	ft^3/s	Pa	psi
1900	345	58	136	6,3	222,5	265	0,038
0,84	469	59	138	6,5	229,5	195	0,028
		61	142	7	247,2	0	

Engine management system

Functionality	Alternatives			Default setting
Governor mode		Isochronous		
Governor droop		0		
Governor response		Adjustable PI-constants		1
Idle speed		600-900		700
Stop function		Energized to run/Stop		
Preheating function		On/Off		
Lamp test		On/Off		

Engine sensors and switch settings			Alarm level		Engine protection	
Parameter		**Unit**	**Setting range**	**Default setting**	**Level**	**Action. Default/Alternative**
Oil temp		°C	Setting +5	125		Shut down, ON/OFF*
Oil pressure	Low idle	kPa	50	25,0		Shut down, ON/OFF*
	Rated speed	kPa	300	275		Shut down, ON/OFF*
Oil level						
Piston cooling pressure >1000 rpm		kPa				
Coolant temp		°C	107	105		Shut down, ON/OFF*
Coolant level			See cooling system	On		
Fuel feed pressure	1200rpm	kPa	100			
Water in fuel			Alarm When Closed			
Crank case pressure		kPa	Rapid Pres inc			Shut down,
Air filter pressure drop				5		
Altitude, above sea		m				Automatic derating, see section derating
Charge air temp		°C	125	120		Shut down, ON/OFF*
Charge air pressure		kPa	Alarm map value +30kPa	Warning map value +20kPa		Shut down, ON/OFF*
Engine speed		rpm	x % of rated speed	125% of rated speed	Alarm level	Shut down, ON/OFF*

* Off means no shut down, alarm only

Parameter	Warning	Alarm	Derated 0% to engine protection map	Derated 100% to engine protection map	Forced idle after sec	Forced shut down after 2 sec
Coolant temp	105°C	107°C	107°C	108°C	N/A	N/A
Oil temp	125°C	127°C	127°C	130°C	N/A	N/A
Low oil pressure	Warning map value	Alarm map value	N/A	N/A	N/A	Alarm map value
High charge air temp	120°C	125°C	125°C	126°C	N/A	N/A
High charge air pressure	Warning map value	Alarm map value	Alarm map value	Alarm map value	N/A	N/A

Electrical system

Voltage and type					24V		
Alternator:	output	A			110/150		
	tacho output	Hz/alternator rev.			6		
	drive ratio				5,25		
Starter motor:		type			105P70 / (105P70 ISS för start/stop)		
		output	kW		7		
			hp		9,5		
Number of teeth on:		flywheel			153		
		starter motor			12		
Inlet manifold heater (at 20 V)			kW		3		
Power relay for the manifold heater			A		1		
Conditions:	**Temperature**		**°C**		**25**	**0**	**-15**
(4 mΩ main circuit resistance@	**Battery**		**Ah / CCA**		**235 / 1300**	**145 / 1050**	**145 / 1050**
Crank speed			rpm		171	118	98
Crank current			A		290	400	480
Starter input power during crank			kW		6,2	7,5	7,7
Battery power during crank			kW		6,5	8,1	8,5
Min battery @ 0°C			Ah / CCA		140/800		

Power take off		**rpm**	**1200**	**1500**	**1800**	**1900**
Front end in line with crank shaft max:*		Nm	2300	2140	1560	1620
(with a total added mass moment of inertia, J (mR2)≤ 0,05 kgm²)		lbf ft	1696	1578	1151	1195
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	42	53	62	68
		hp	57	72	84	92
	max down	kW	36	44	52	60
		hp	49	60	71	82
	max right	kW	42	53	62	68
		hp	57	72	84	92
Timing gear at servo pump PTO max:*		Nm	100			
		lbf ft	74			
Speed ratio direction of rotation viewed from flywheel side			1,58:1/ccw			
Maximum torque on timing gear at rear PTO : *		Nm	1000			
		lbf ft	738			
Speed ratio direction of rotation viewed from flywheel side			1,31:1/ccw			
Timing gear at compressor PTO max:*		Nm	600			
		lbf ft	443			
Speed ratio direction of rotation viewed from flywheel side			1,31:1/ccw			
Max allowed bending moment in flywheel housing		Nm	15000			
		lbf ft	11063			
Max. rear main bearing load		N	4000			
		lbf	899,2			

**** Maximum allowed torque at individual PTO´s.***
If more then one PTO output is used simultaniusly, calculations needs to be performed to determine available maximum. Available torque depends on application inertia.

Performance	Power (kW)	Rpm
IFN Power	345	1900

Sensors Alarm	Signal	Range	Alarm switch	Alarm Level	Derating level	Condition/Delay	Derating
Boost pressure	0,5-4,5 V	50 - 400 kPa	N/A	map value+30 kPa	map		Soft derate VE/
Boost temperaure	50-0 kΩ	-40° - 130 °C	N/A	120°C	125°C		Soft derate VE/
Coolant level switch	Digital		Alarm when closed	Low			
Coolant temperature	50-0 kΩ	-40° - 140 °C	N/A	105°C	107°C		Soft derate VE/
Crankcase pressure	0,5-4,5 V	0 -15 kPa	N/A	Rapid pres inc	Rapid pres inc		Shutdown
Engine Speed Cam	Frequency		N/A	Lost sign			N/A
Engine Speed Crank	Frequency		N/A	Lost sign			N/A
Exhaust gas temp			N/A	550	575		Soft derate VE/
Oil level sensor			Alarm when low level	N/A	N/A		N/A
Oil temperature	50-0 kW	-40° - 140 °C	N/A	125°C	127°C		Soft derate VE/

Sensors Alarm	Signal	Range	rpm Map					Condition	Derating
Charge Air pressure	0,5-4,5 V	50 - 400 kPa	**600**	**1000**	**1200**	**1500**	**1900**		
Warning Level			363	363	363	335	290		
Alarm Level			373	373	373	345	300		Soft derate VE/
Oil pressure	0,5-4,5 V	0-700 kPa	**0**	**500**	**1000**	**1500**	**1900**		
Warning Level			1	50	200	300	300		
Alarm Level			1	25	175	275	275		Shut down
Fuel pressure	0,5-4,5 V	0-700 kPa	**600**	**1000**	**1200**	**1800**	**1900**		
Warning Level			100	100	100	300	300		
Alarm Level			N/A	N/A	N/A	N/A	N/A		

Remarks

1) Soft derate Coolant temp	Speed / °C	105°C	107C	108°C	
Remaining torque in %	600	100%	100%	85%	
	1200	100%	100%	40%	
	1500	100%	100%	0%	

Derate map R2			
°C	105	107	108
%	0	0	100

2) Soft derate Oil temp	Speed / °C	125°C	127°C	130°C	
Remaining torque in %	600	100%	100%	85%	
	1200	100%	100%	40%	
	1500	100%	100%	0%	

Derate map R2			
°C	125	127	130
%	0	0	100

3)Soft derate Boost Temp	Speed / °C	120°C	125°C	126°C	
Remaining torque in %	600	100%	100%	85%	
	1200	100%	100%	40%	
	1500	100%	100%	0%	

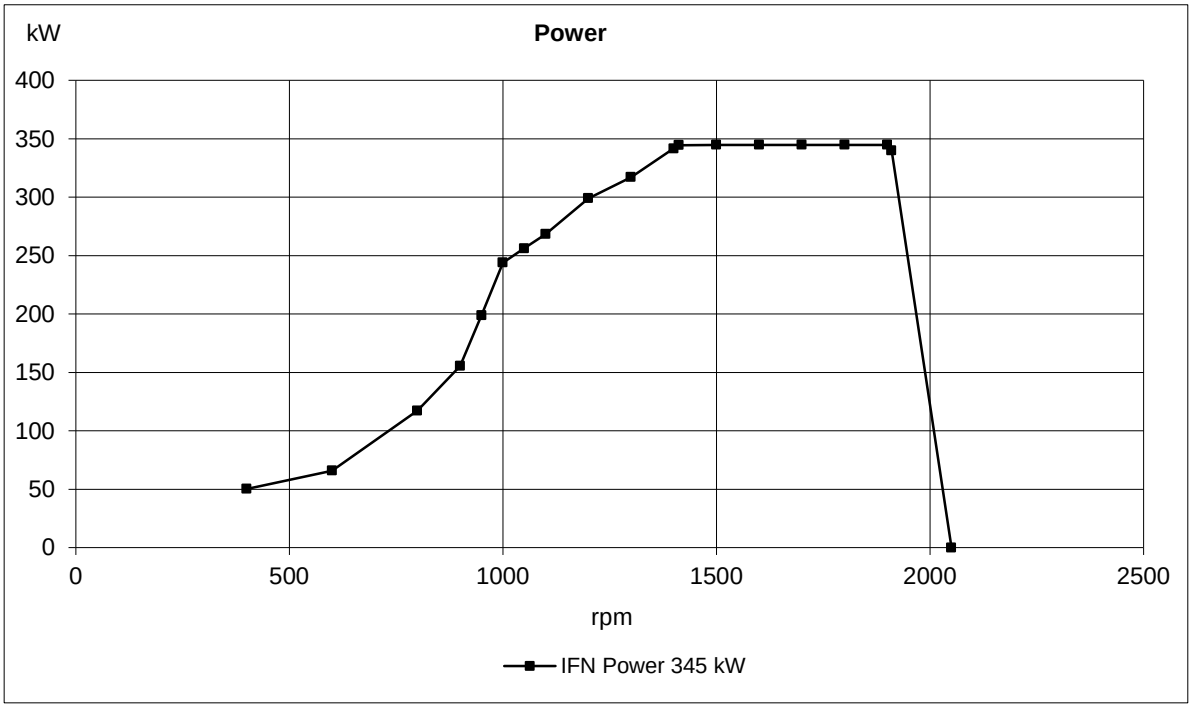
Derate map R2			
°C	120	125	126
%	0	0	100

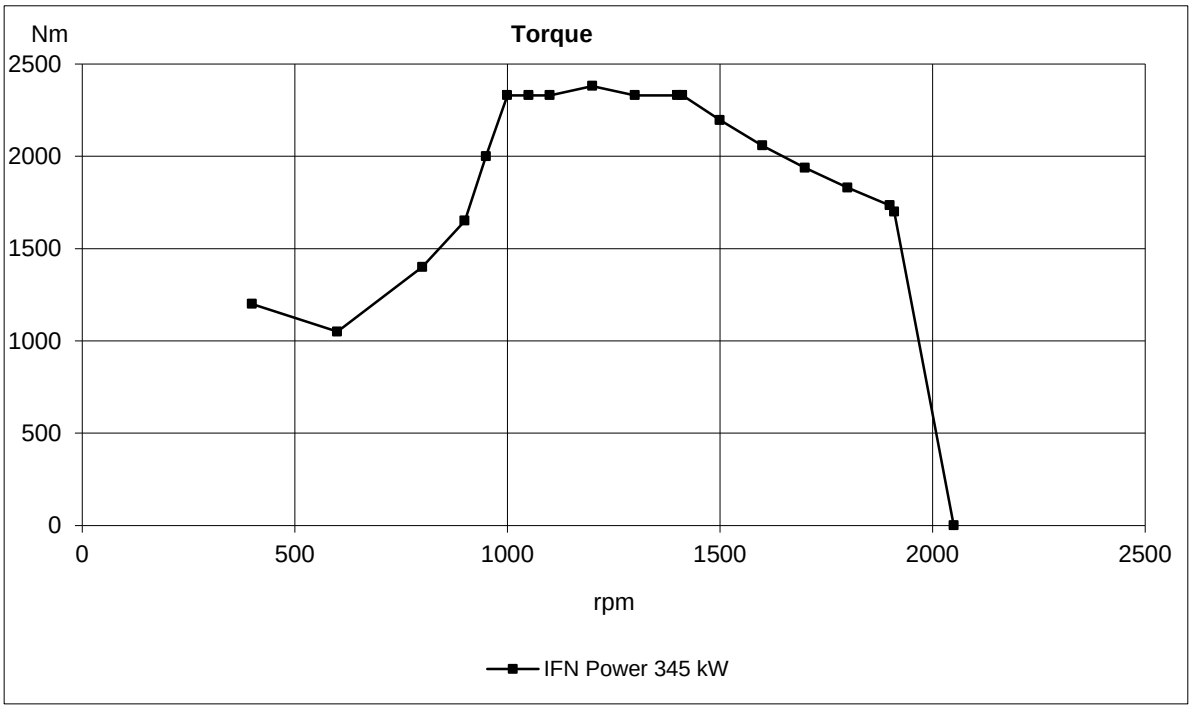
4)Soft derate Exhaust temp	Speed / °C	550°C	560°C	575°C	580°C
Remaining torque in %	600	100%	100%	100%	85%
	1200	100%	100%	100%	40%
	1500	100%	100%	100%	0%

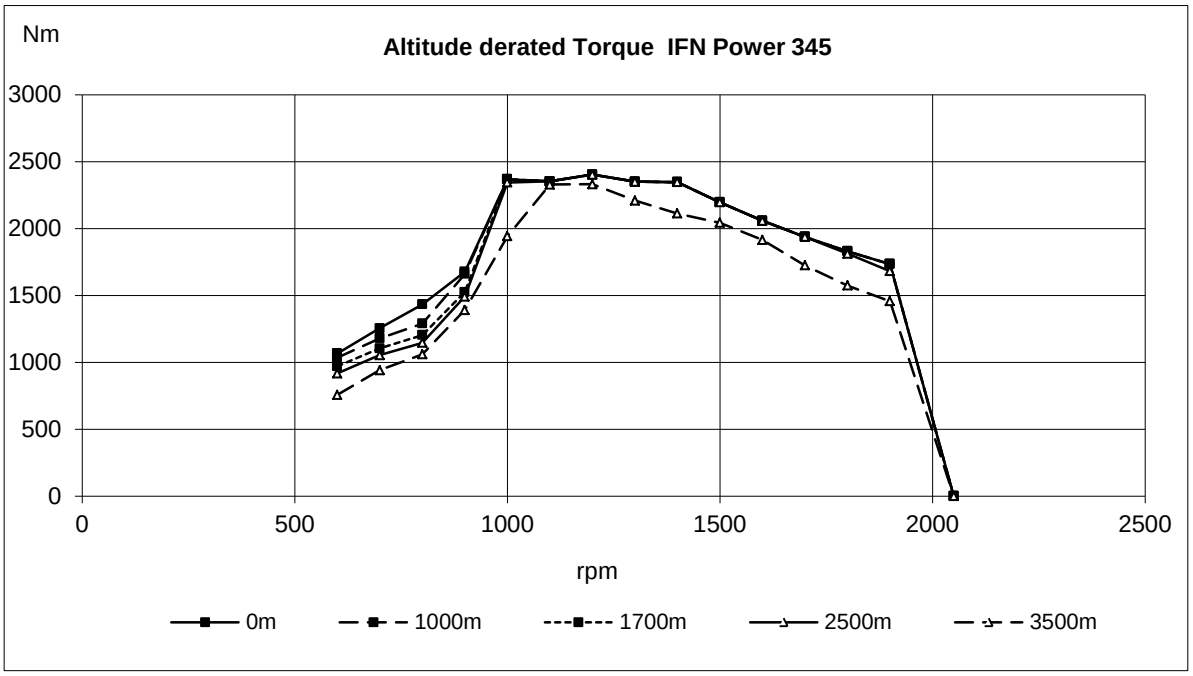
Derate map R2					
°C	550	560	575	580	
%	0	0	0	100	

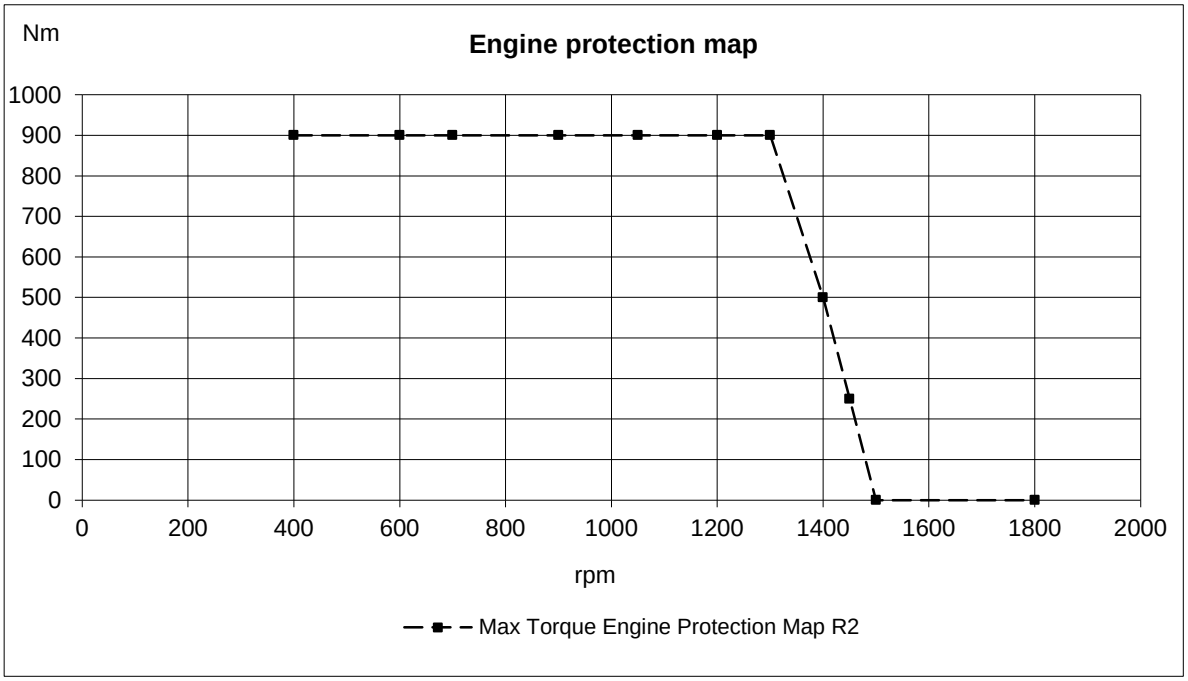
Max Torque High Map R2	400	600	700	800	900	1000	1050	1100	1200	1250	1300
	1200	1050	1225	1400	1650	2330	2330	2330	2380	2355	2330
	1400	1450	1500	1600	1700	1800	1900	1910	2009		
	2330	2272	2195	2058	1937	1830	1733	1700	500		

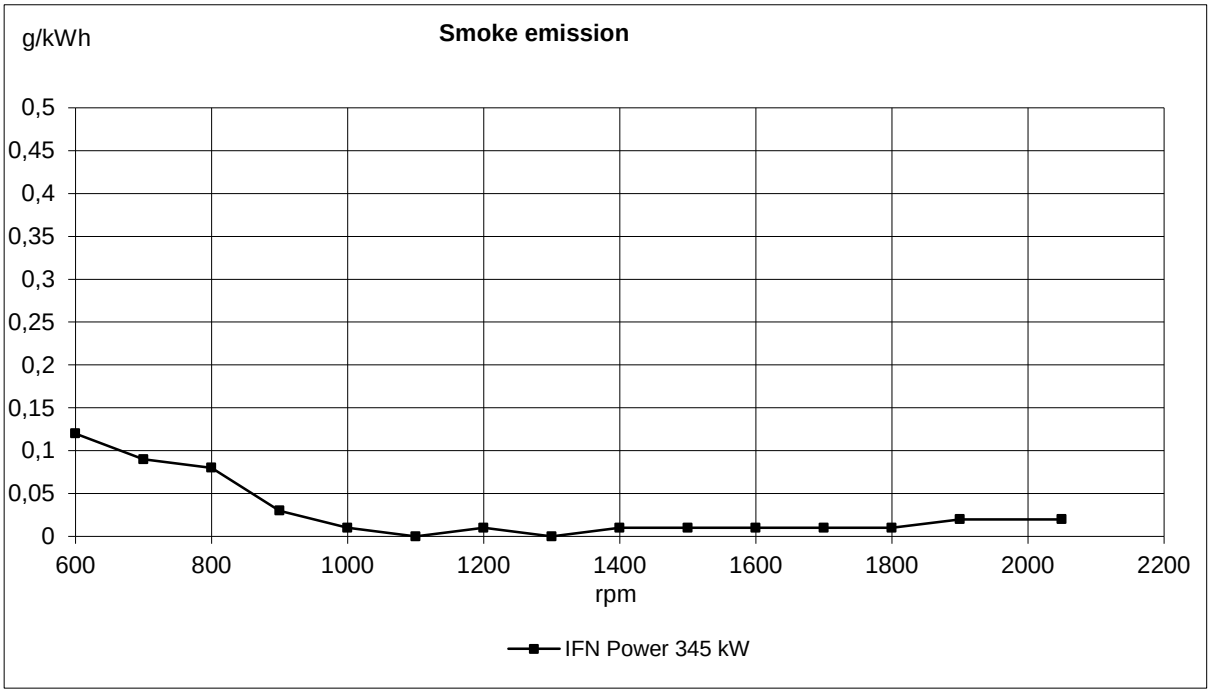
Max Torque Engine Protection Map R2	400	600	700	900	1050	1200	1300	1400	1450	1500	1800
	900	900	900	900	900	900	900	500	250	0	0

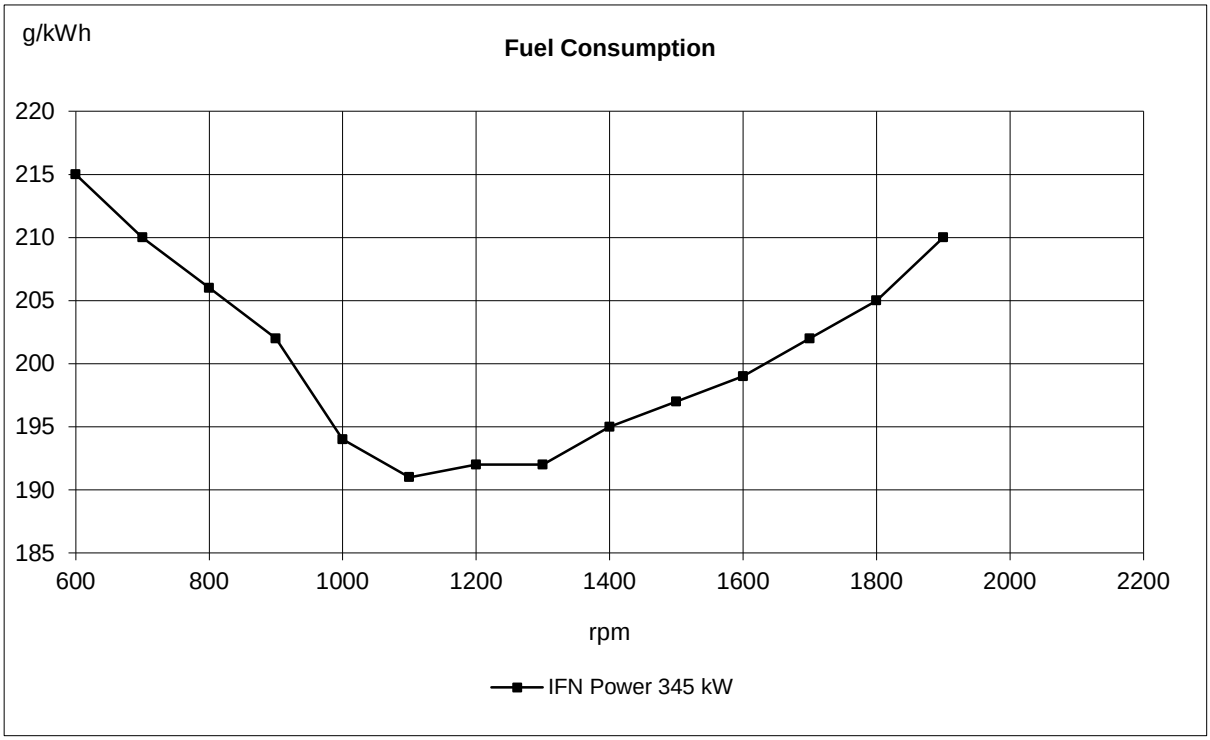

kW
Power
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
rpm
IFN Power 345 kW

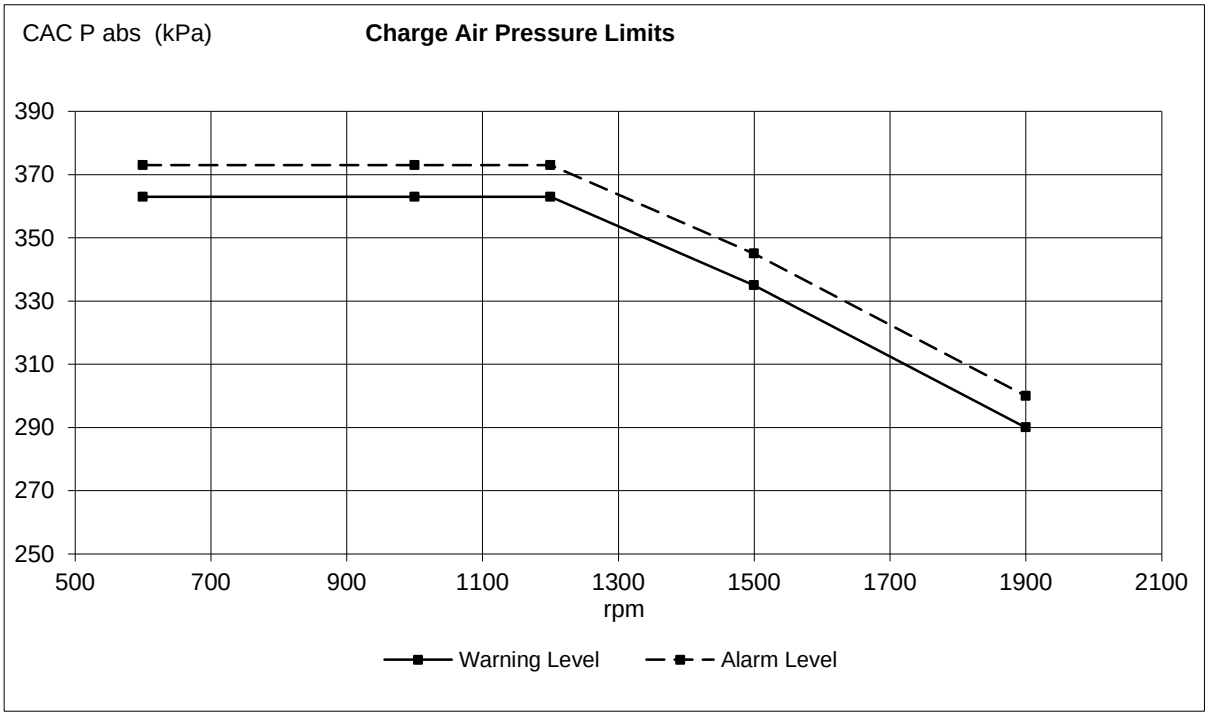

Nm
Torque
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
rpm
IFN Power 345 kW

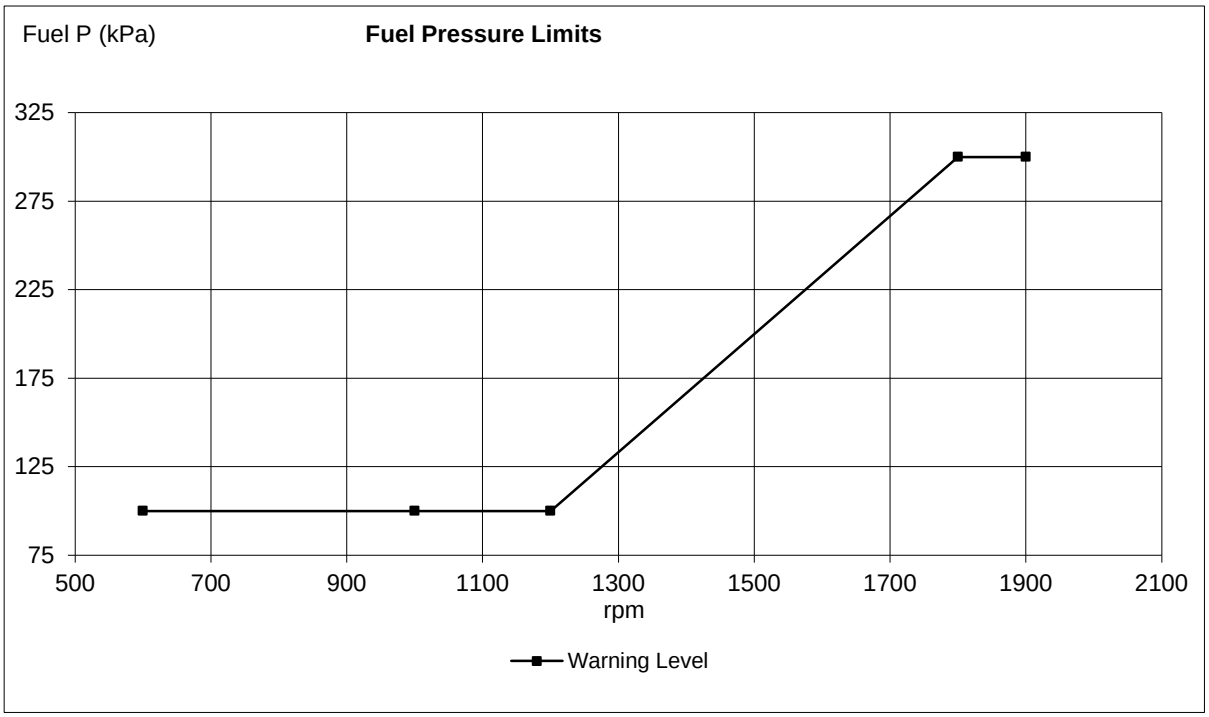

Nm
Altitude derated Torque IFN Power 345
3000
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
rpm
0m
1000m
1700m
2500m
3500m

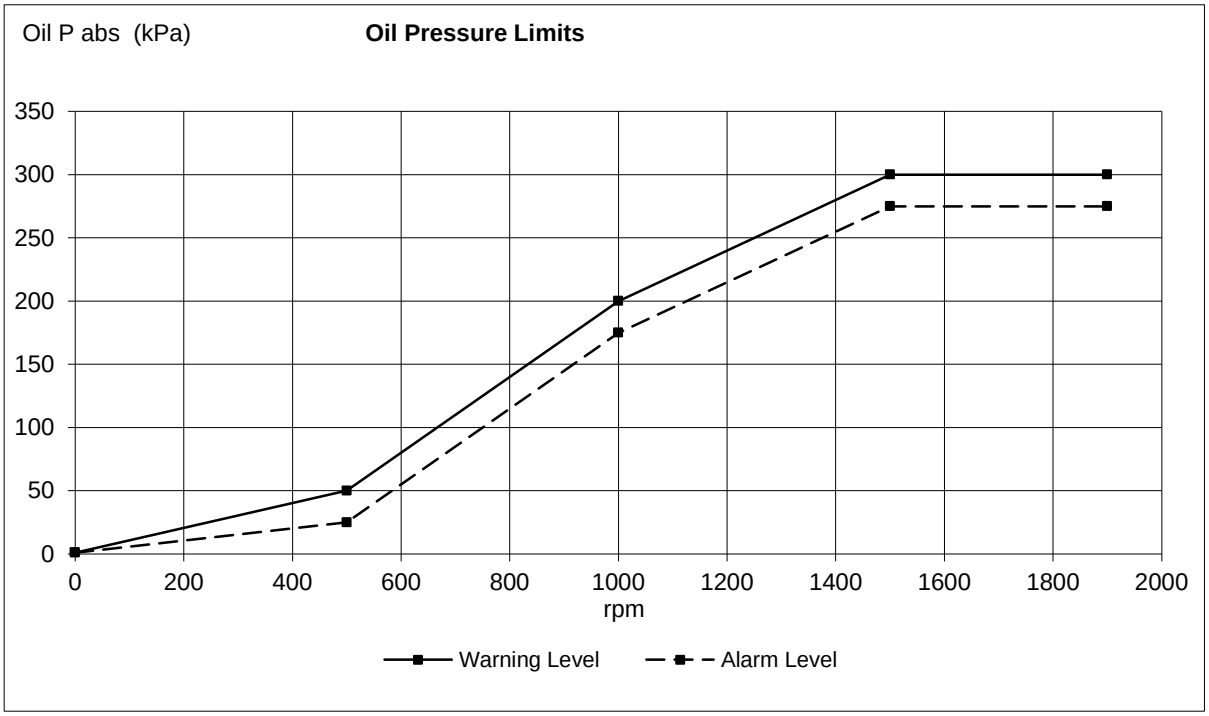

Nm
Engine protection map
1000
900
800
700
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
rpm
Max Torque Engine Protection Map R2

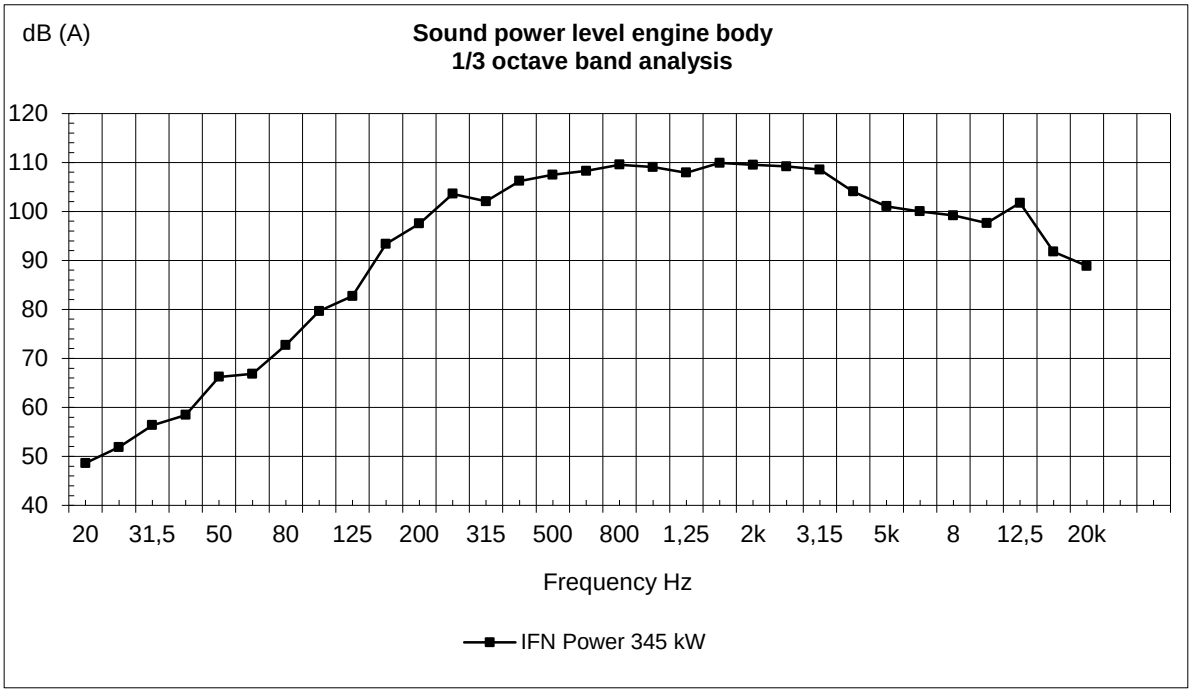

Smoke emission
g/kWh
0,5
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
600
800
1000
1200
1400
1600
1800
2000
2200
rpm
IFN Power 345 kW

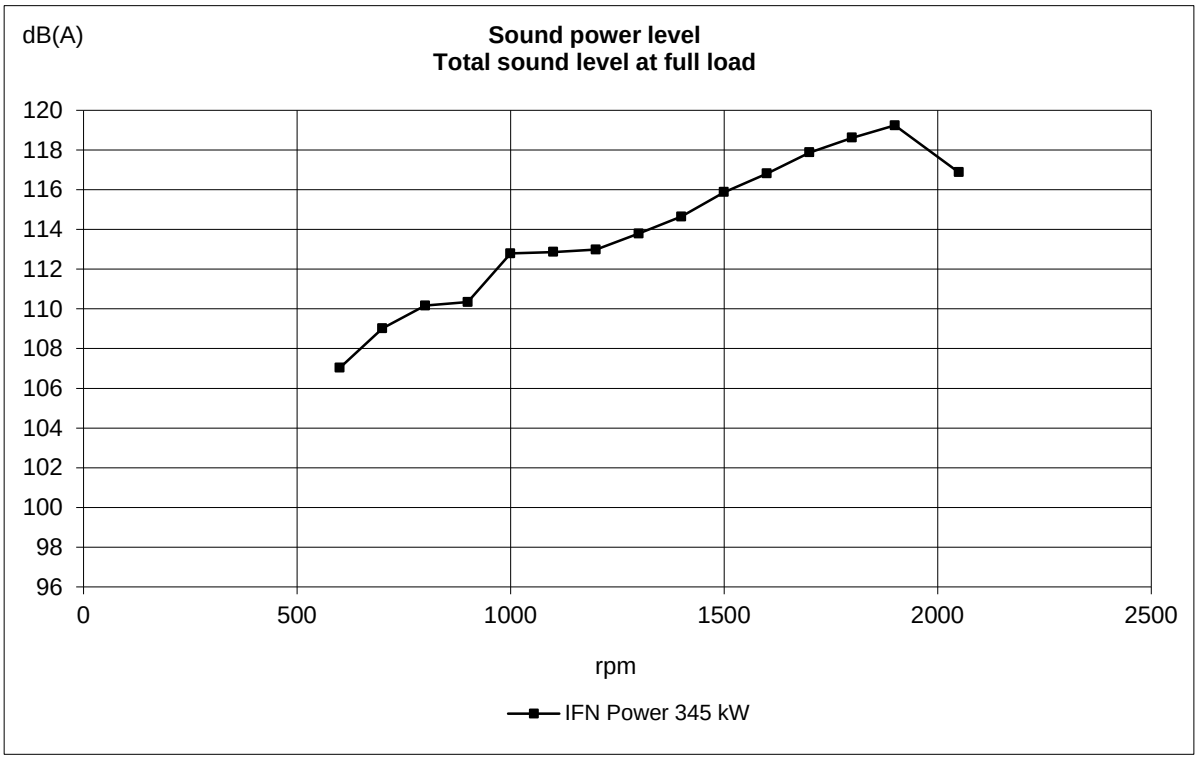

g/kWh
Fuel Consumption
220
215
210
205
200
195
190
185
600
800
1000
1200
1400
1600
1800
2000
2200
rpm
IFN Power 345 kW

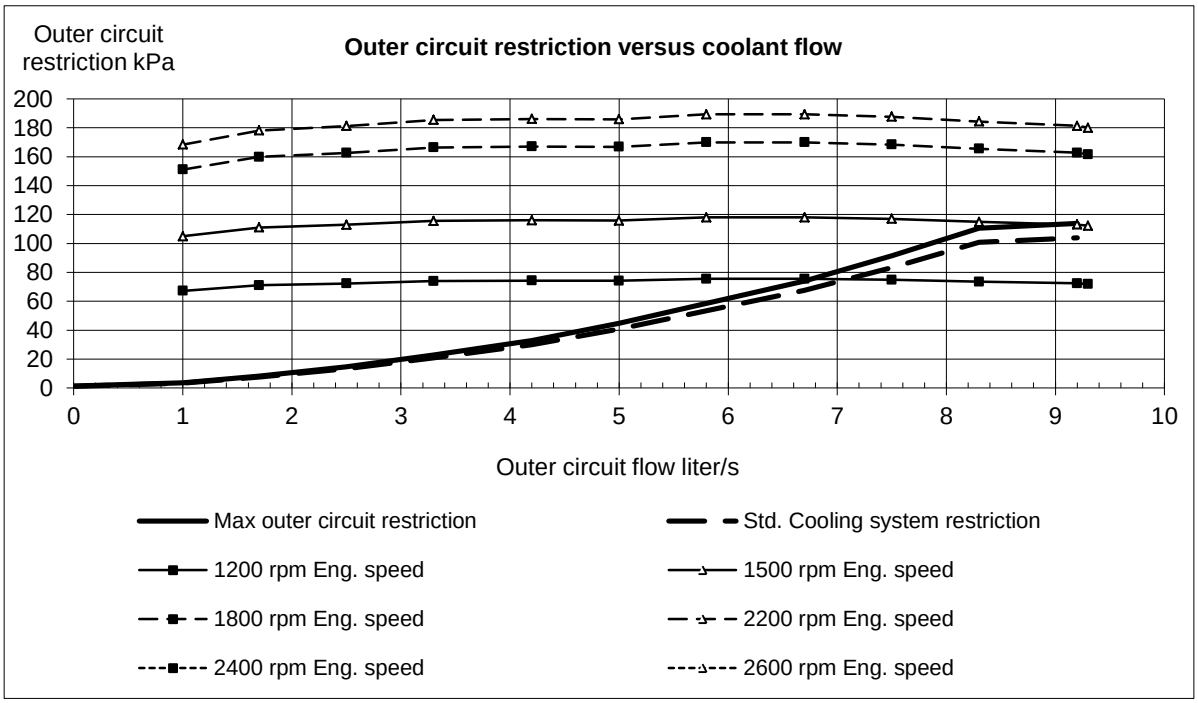

CAC P abs (kPa)
Charge Air Pressure Limits
390
370
350
330
310
290
270
250
500
700
900
1100
1300
1500
1700
1900
2100
rpm
Warning Level
Alarm Level

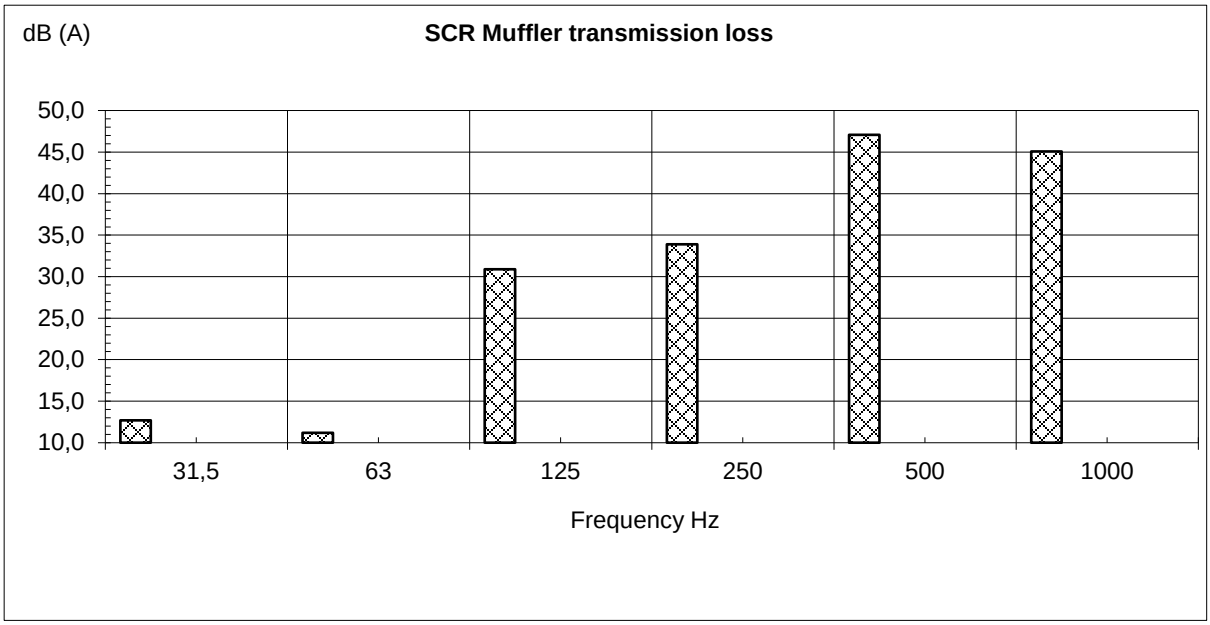

Fuel P (kPa)
Fuel Pressure Limits
325
275
225
175
125
75
500
700
900
1100
1300
1500
1700
1900
2100
rpm
Warning Level

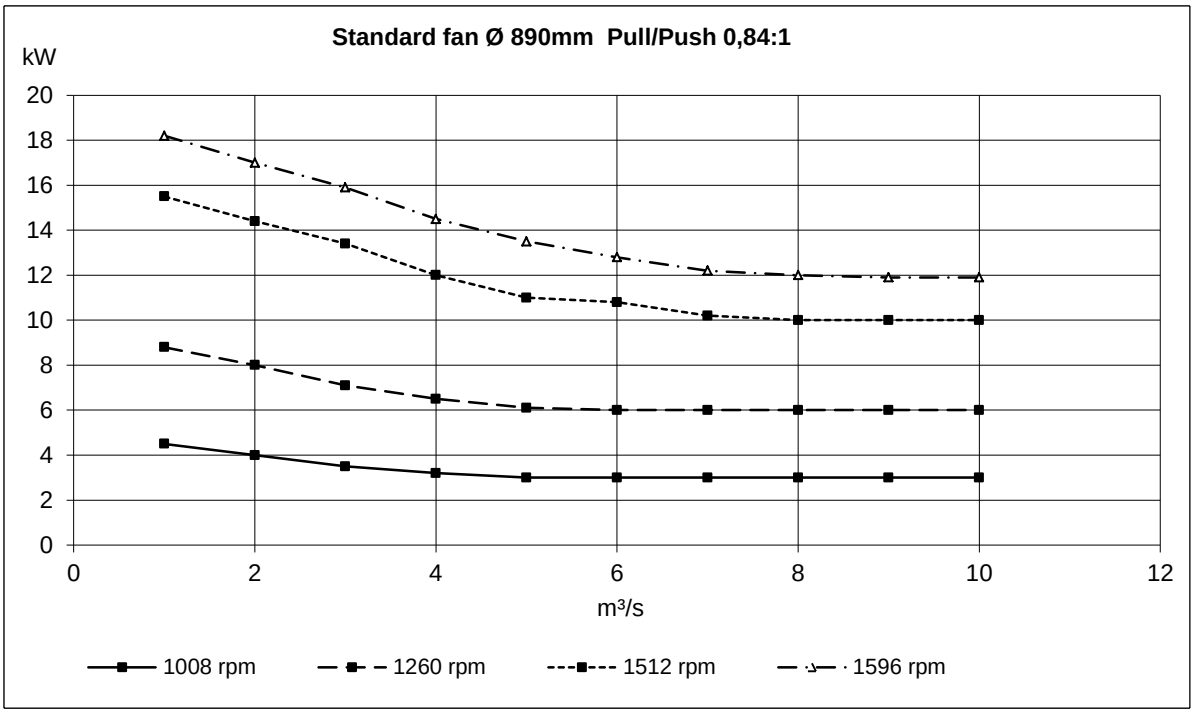

Oil P abs (kPa)
Oil Pressure Limits
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
rpm
Warning Level
Alarm Level

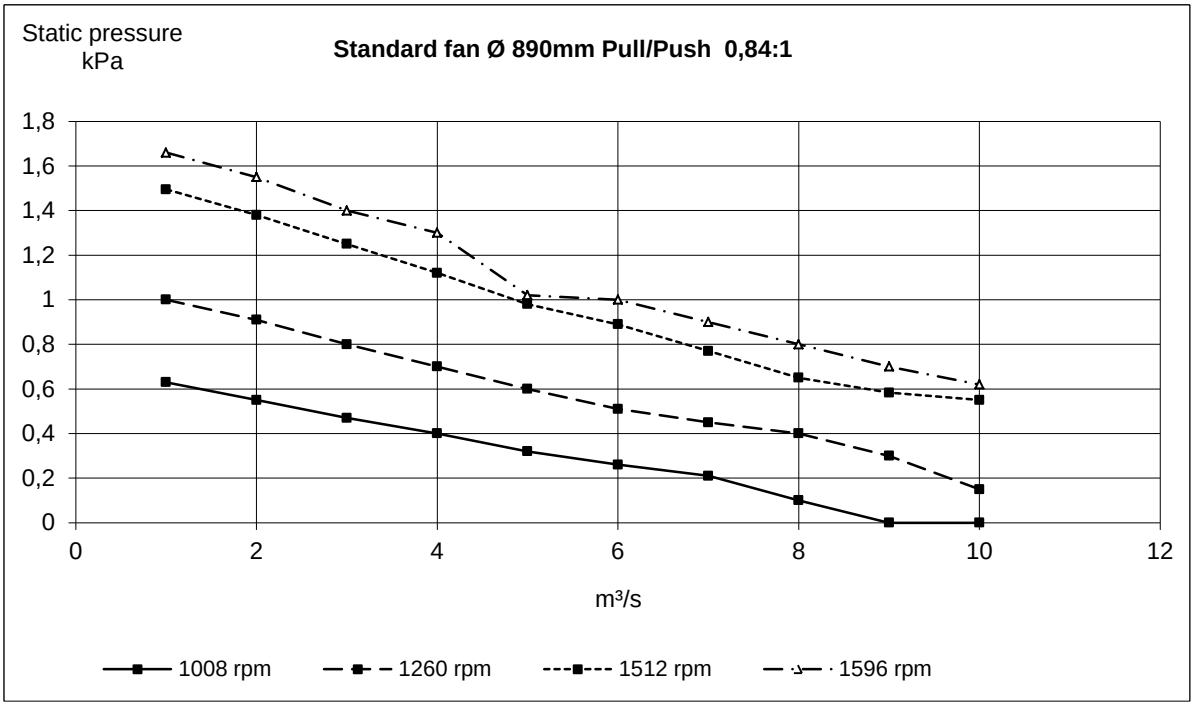

dB (A)
Sound power level engine body
1/3 octave band analysis
120
110
100
90
80
70
60
50
40
20
31,5
50
80
125
200
315
500
800
1,25
2k
3,15
5k
8
12,5
20k
Frequency Hz
IFN Power 345 kW


dB(A)
Sound power level
Total sound level at full load
120
118
116
114
112
110
108
106
104
102
100
98
96
0
500
1000
1500
2000
2500
rpm
IFN Power 345 kW

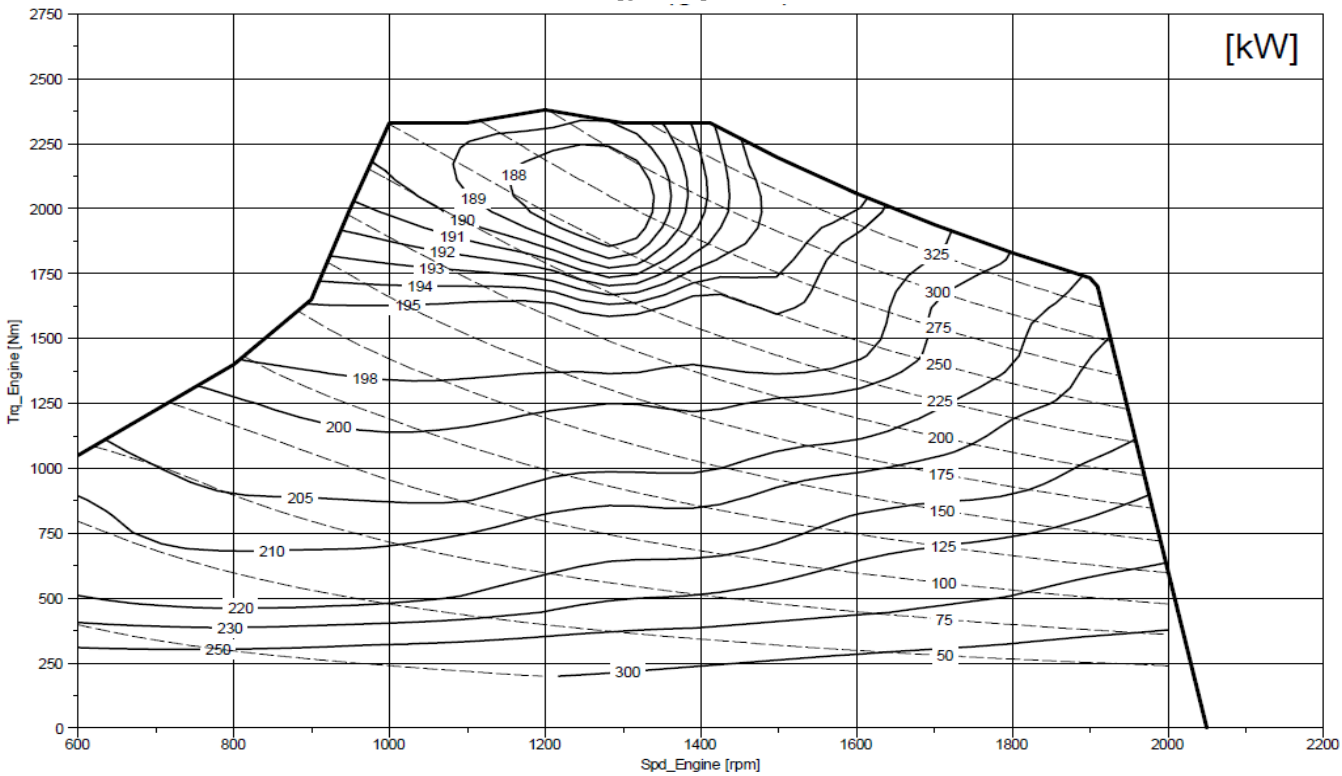

Outer circuit restriction kPa
Outer circuit restriction versus coolant flow
200
180
160
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
Outer circuit flow liter/s
Max outer circuit restriction
Std. Cooling system restriction
1200 rpm Eng. speed
1500 rpm Eng. speed
1800 rpm Eng. speed
2200 rpm Eng. speed
2400 rpm Eng. speed
2600 rpm Eng. speed


dB (A)
SCR Muffler transmission loss
50,0
45,0
40,0
35,0
30,0
25,0
20,0
15,0
10,0
31,5
63
125
250
500
1000
Frequency Hz

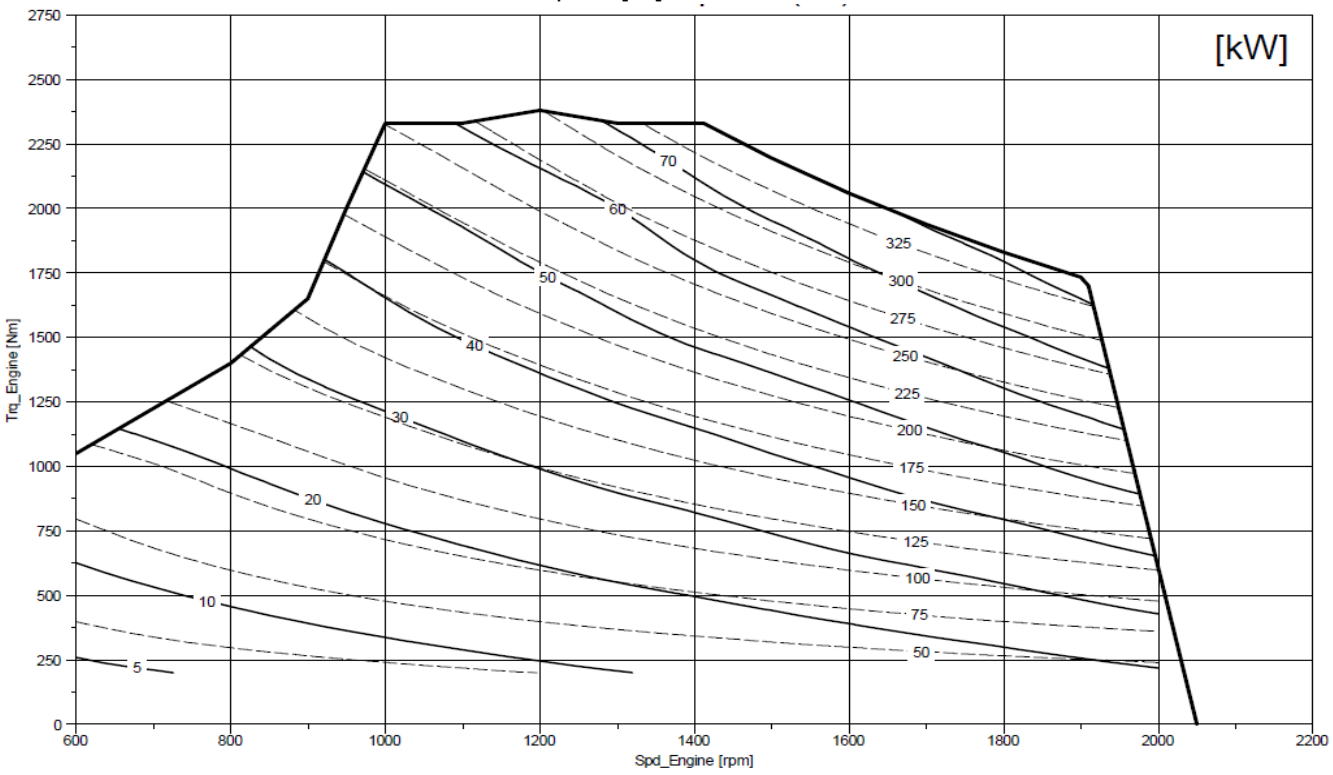

Standard fan Ø 890mm Pull/Push 0,84:1
kW
20
18
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
m³/s
1008 rpm
1260 rpm
1512 rpm
1596 rpm


Static pressure
kPa
Standard fan Ø 890mm Pull/Push 0,84:1
1,8
1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
0
2
4
6
8
10
12
m³/s
1008 rpm
1260 rpm
1512 rpm
1596 rpm

BSFC [g/kWh]



Fuel consumption [l/h]



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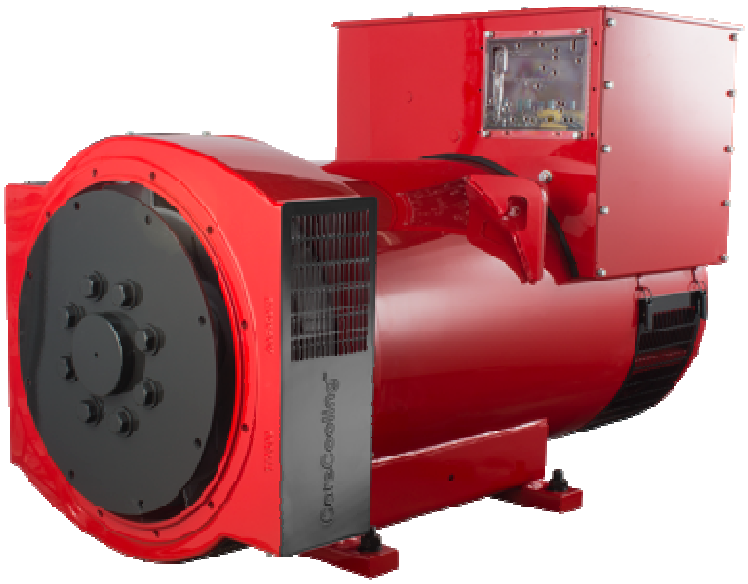
S4L1D-F41 Wdg.311 - Technical Data Sheet

Standards

Stamford industrial alternators meet the requirements of the relevant parts of the BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100 and AS1359. Other standards and certifications can be considered on request.

Quality Assurance

Alternators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.



Excitation and Voltage Regulators

Excitation System					
AVR Type	AS440	MX341	MX321		
Voltage Regulation	± 1%	± 1%	± 0.5%		with 4% Engine Governing
Excitation Type	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	10 - 8
No Load Excitation Current (A)	0.7 - 0.5
Full Load Excitation Voltage (V)	41 - 37.5
Full Load Excitation Current (A)	2.3 - 2.1
Exciter Time Constant (seconds)	0.105

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Electrical Data								
Insulation System	Class H							
Stator Winding	Double Layer Lap							
Winding Pitch	Two Thirds							
Winding Leads	12							
Winding Number	311							
Number of Poles	4							
IP Rating	IP23							
RFI Suppression	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. Refer to factory for others							
Waveform Distortion	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
Short Circuit Ratio	1/Xd							
Steady State X/R Ratio	13.7389							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.76 m³/sec				0.92 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	400	415	415	400	455	500	500	520
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.71	2.54	2.36	2.02	3.28	3.23	2.95	2.82
X'd Dir. Axis Transient	0.18	0.17	0.16	0.13	0.18	0.18	0.16	0.16
X"d Dir. Axis Subtransient	0.13	0.13	0.12	0.10	0.13	0.13	0.12	0.11
Xq Quad. Axis Reactance	2.34	2.19	2.03	1.74	2.90	2.84	2.60	2.49
X"q Quad. Axis Subtransient	0.31	0.29	0.27	0.23	0.42	0.42	0.38	0.36
XL Stator Leakage Reactance	0.06	0.05	0.05	0.04	0.07	0.07	0.07	0.06
X2 Negative Sequence Reactance	0.22	0.21	0.20	0.17	0.29	0.29	0.26	0.25
X0 Zero Sequence Reactance	0.09	0.08	0.08	0.07	0.10	0.10	0.09	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.26	3.05	2.83	2.43	3.94	3.87	3.54	3.38
X'd Dir. Axis Transient	0.21	0.19	0.18	0.15	0.21	0.21	0.19	0.18
X"d Dir. Axis Subtransient	0.16	0.15	0.14	0.12	0.16	0.15	0.14	0.13
Xq Quad. Axis Reactance	2.41	2.26	2.10	1.80	2.98	2.93	2.68	2.56
X"q Quad. Axis Subtransient	0.37	0.35	0.32	0.28	0.51	0.50	0.46	0.44
XL Stator Leakage Reactance	0.06	0.06	0.05	0.05	0.08	0.08	0.07	0.07
Xlr Rotor Leakage Reactance	0.10	0.09	0.09	0.07	0.11	0.11	0.10	0.10
X2 Negative Sequence Reactance	0.27	0.25	0.23	0.20	0.35	0.34	0.31	0.30
X0 Zero Sequence Reactance	0.10	0.10	0.09	0.08	0.11	0.11	0.10	0.10

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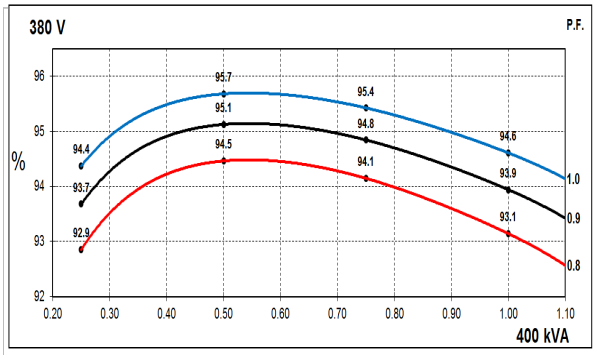
Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.08	
T''d SUB-TRANSTIME CONST.	0.019	
T'do O.C. FIELD TIME CONST.	1.7	
Ta ARMATURE TIME CONST.	0.018	
T''q SUB-TRANSTIME CONST.	0.009	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.0073	
Rotor Winding Resistance (Rf)	1.37	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
PMG Phase Resistance (Rpmg) per phase	1.9	
Positive Sequence Resistance (R1)	0.009125	
Negative Sequence Resistance (R2)	0.010512	
Zero Sequence Resistance (R0)	0.009125	
Saturation Factors	400V	480V
SG1.0	0.36	0.38
SG1.2	1.46	1.52
Mechanical Data		
Shaft and Keys	All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.	
	1 Bearing	2 Bearings
SAE Adaptor	SAE 0.5, 1	N/A
Moment of Inertia	5.4292kgm^2	N/A
Weight Wound Stator	535kg	N/A
Weight Wound Rotor	463kg	N/A
Weight Complete Alternator	1160kg	N/A
Shipping weight in a Crate	1230kg	N/A
Packing Crate Size	155 x 87 x 107 (cm)	N/A
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	N/A
Bearing Non-Drive End	Ball 6314	N/A

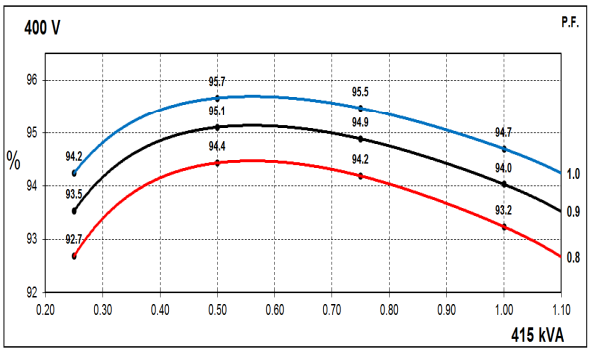
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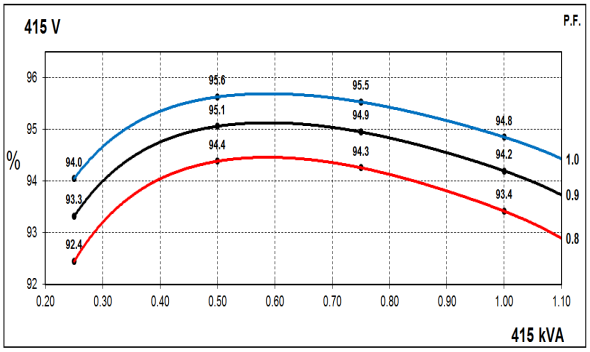
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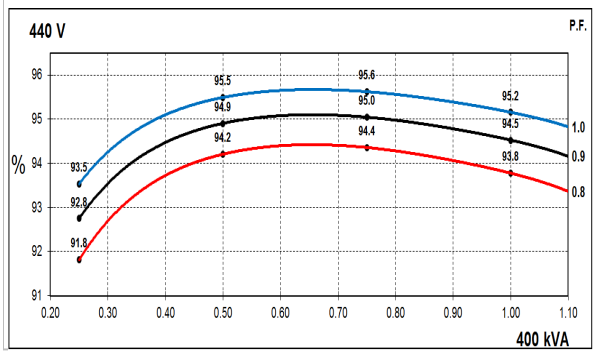
THREE PHASE EFFICIENCY CURVES

50Hz

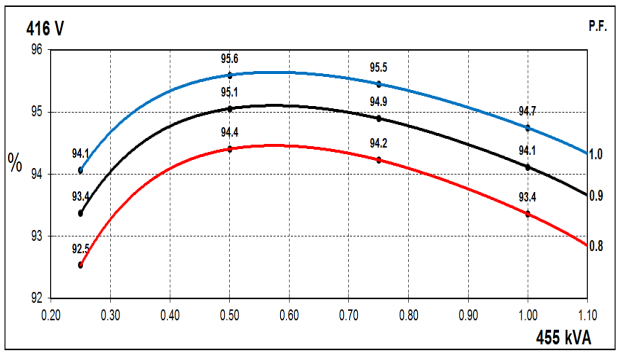


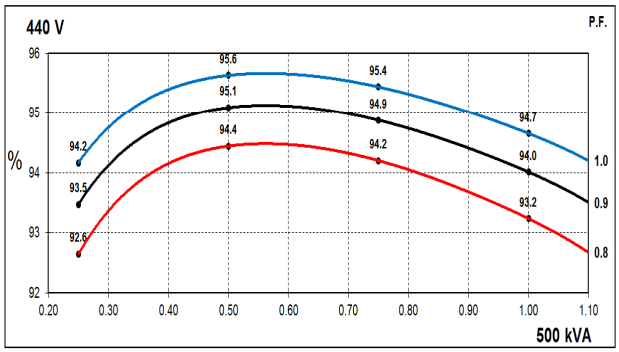


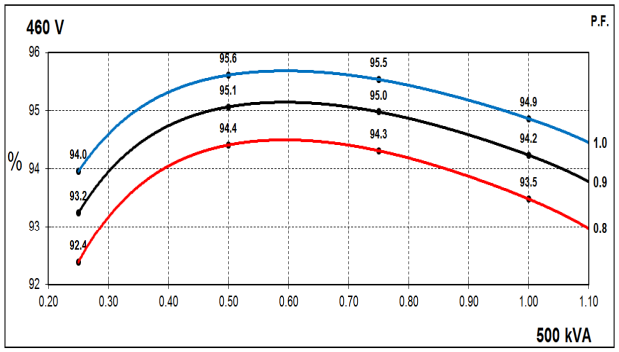


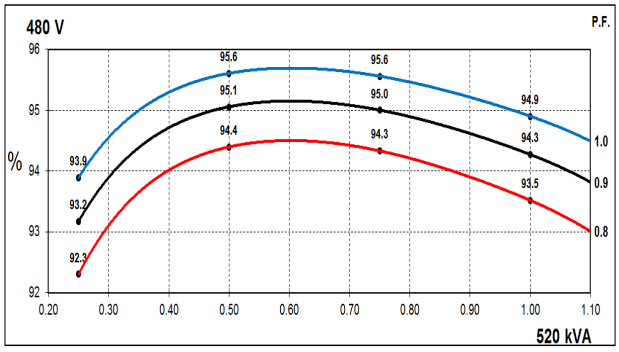


60Hz



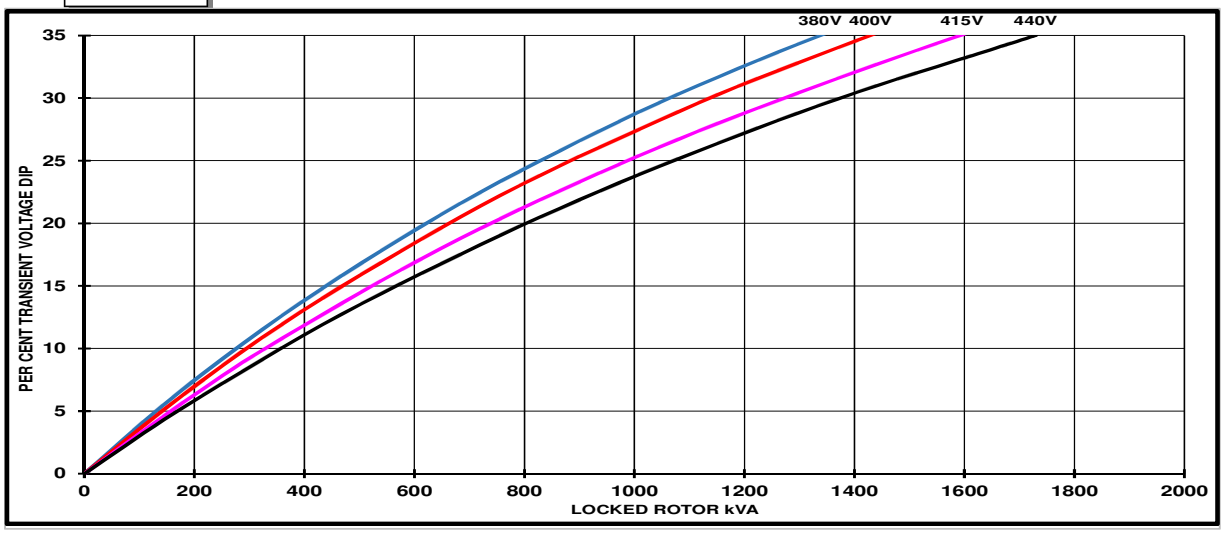




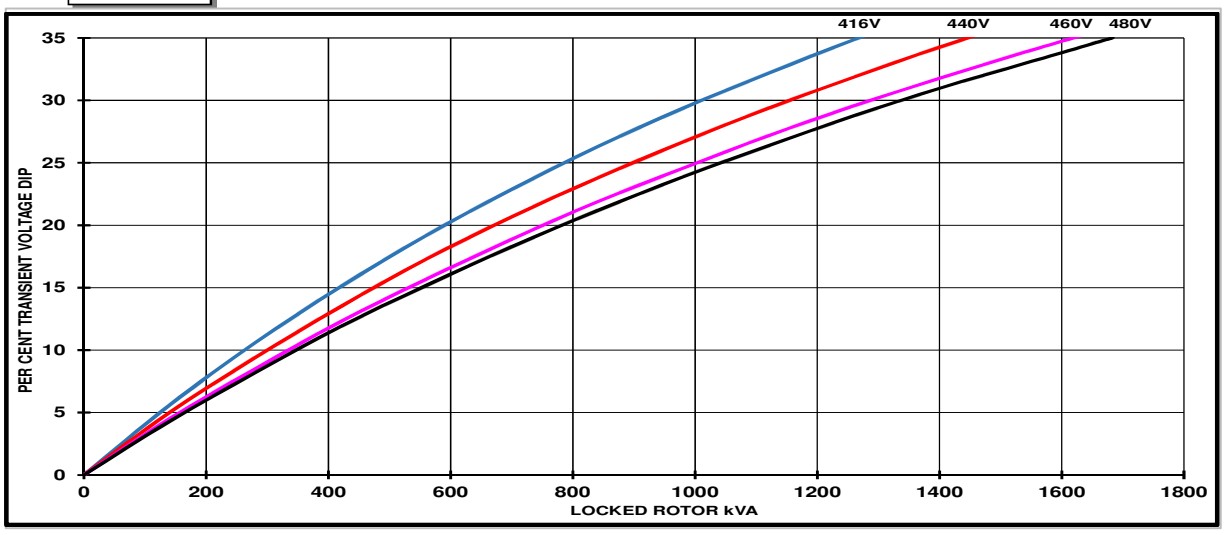


Locked Rotor Motor Starting Curves - Separately Excited

50Hz



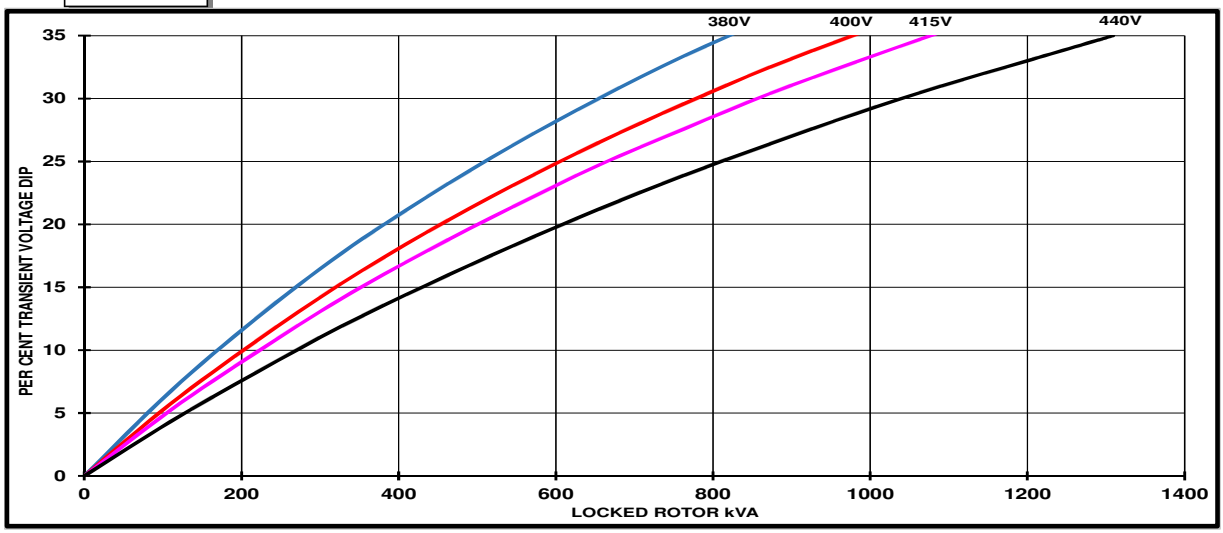
60Hz



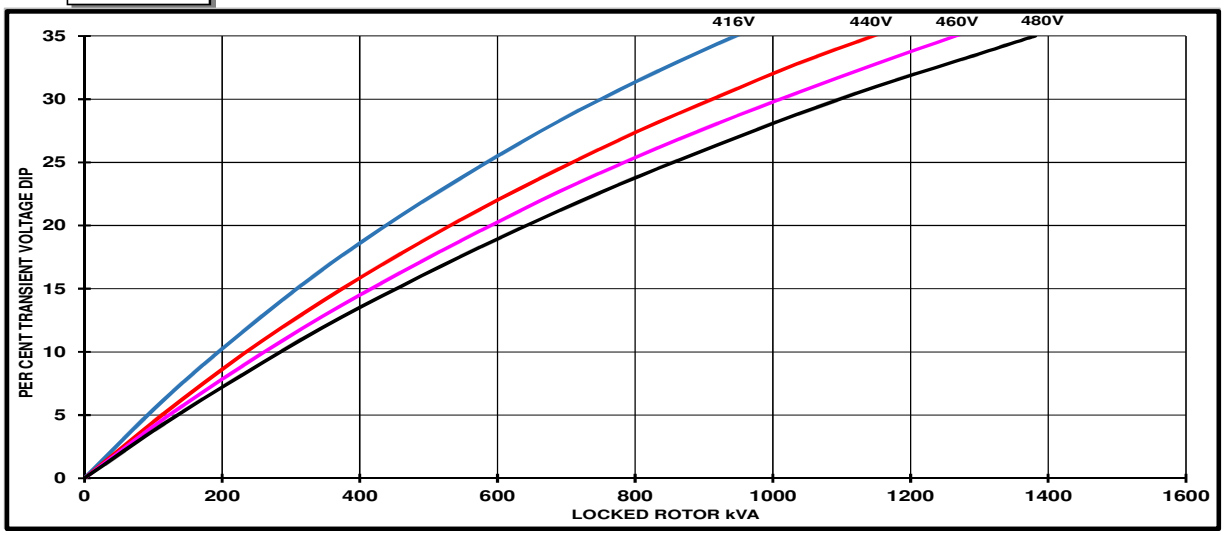
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

Locked Rotor Motor Starting Curves - Self Excited

50Hz



60Hz



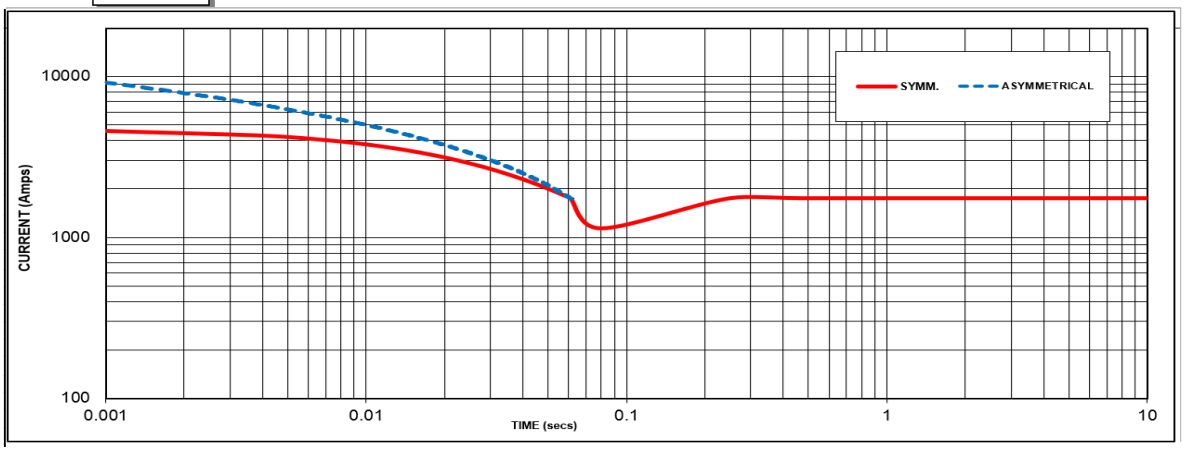
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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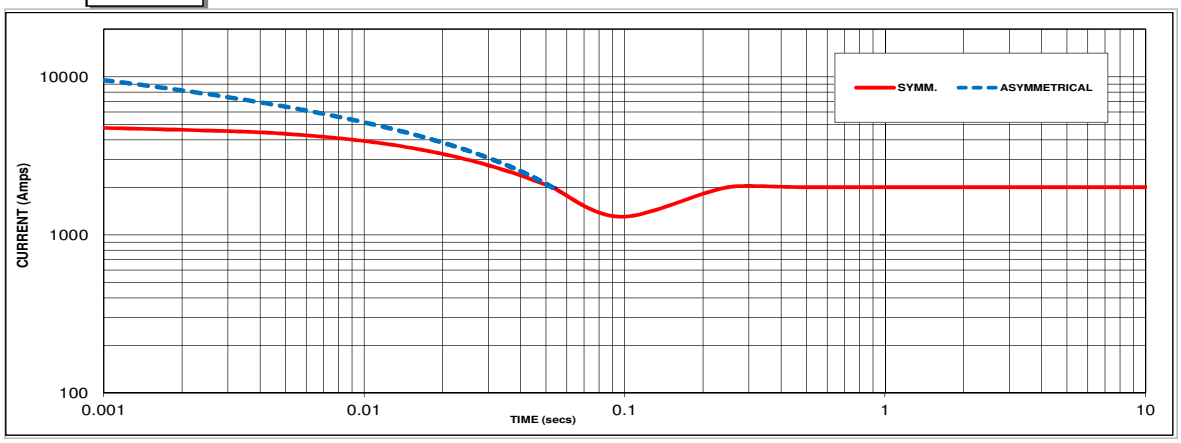
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 1750 Amps

60Hz



Sustained Short Circuit = 2000 Amps

Note 1
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		**60Hz**	
Voltage	Factor	Voltage	Factor
380V	X 1.00	416V	X 1.00
400V	X 1.05	440V	X 1.06
415V	X 1.09	460V	X 1.10
440V	X 1.16	480V	X 1.15

The sustained current value is constant irrespective of voltage level

Note 2
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

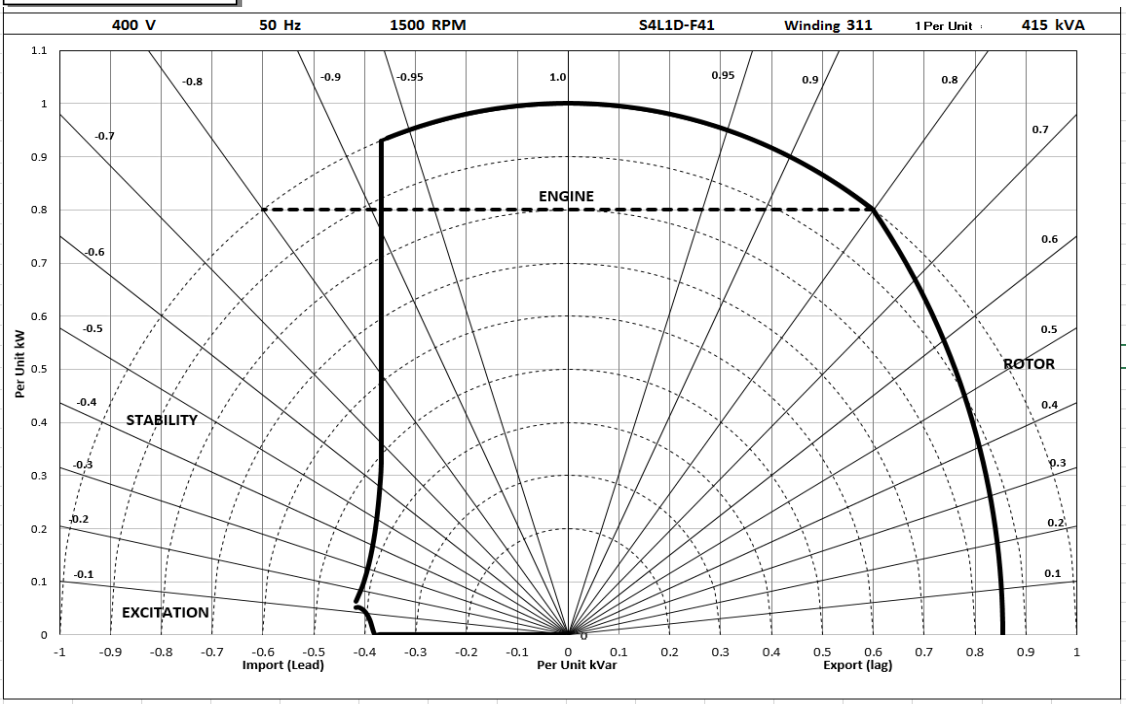
	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

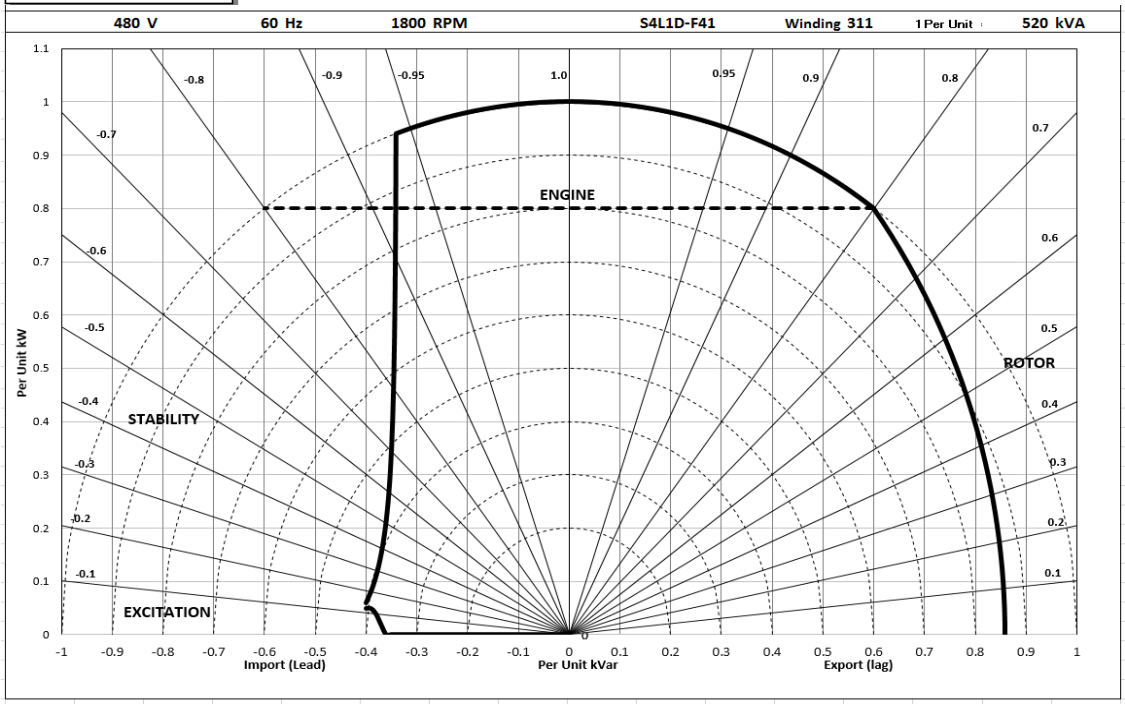
Note 3
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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RATINGS AT 0.8 POWER FACTOR

	Class - Temp Rise	Standby - 163/27°C				Standby - 150/40°C				Cont. H - 125/40°C				Cont. F - 105/40°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	kVA	425	465	455	440	415	445	445	430	400	415	415	400	370	380	380	370
	kW	340	372	364	352	332	356	356	344	320	332	332	320	296	304	304	296
	Efficiency (%)	92.8	92.6	92.9	93.4	92.9	92.9	93.1	93.5	93.1	93.2	93.4	93.8	93.5	93.6	93.8	94.0
	kW Input	366	402	392	377	357	383	383	368	344	356	355	341	317	325	324	315

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	500	550	550	575	485	535	535	555	455	500	500	520	420	465	465	480
	kW	400	440	440	460	388	428	428	444	364	400	400	416	336	372	372	384
	Efficiency (%)	92.9	92.7	93.0	93.0	93.0	92.9	93.2	93.2	93.4	93.2	93.5	93.5	93.7	93.6	93.8	93.8
	kW Input	431	475	473	495	417	461	459	476	390	429	428	445	359	398	397	409

De-Rates

All values tabulated above are subject to the following reductions:

- 5% when air inlet filters are fitted
- 3% for every 500 meters by which the operating altitude exceeds 1000 meters above mean sea level
- 3% for every 5°C by which the operational ambient temperature exceeds 40°C
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60°C and altitude exceeding 4000 meters must be referred to applications.

Dimensional and Torsional Drawing

For dimensional and torsional information please refer to the alternator General Arrangement and rotor drawings available on our website (http://stamford-avk.com/)

Note: Continuous development of our products means that the information contained in our data sheets can change without notice, and specifications should always be confirmed with Cummins Generator Technologies prior to purchase.



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S4LID-E41 Wdg.311 - Technical Data Sheet

Standards

Stamford industrial alternators meet the requirements of the relevant parts of the BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100 and AS1359. Other standards and certifications can be considered on request.

Quality Assurance

Alternators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.



Excitation and Voltage Regulators

Excitation System					
AVR Type	AS440	MX341	MX321		
Voltage Regulation	± 1%	± 1%	± 0.5%		with 4% Engine Governing
Excitation Type	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	12 - 9
No Load Excitation Current (A)	0.7 - 0.5
Full Load Excitation Voltage (V)	41 - 39
Full Load Excitation Current (A)	2.3 - 2.2
Exciter Time Constant (seconds)	0.105

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Electrical Data								
Insulation System	Class H							
Stator Winding	Double Layer Lap							
Winding Pitch	Two Thirds							
Winding Leads	12							
Winding Number	311							
Number of Poles	4							
IP Rating	IP23							
RFI Suppression	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. Refer to factory for others							
Waveform Distortion	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
Short Circuit Ratio	1/Xd							
Steady State X/R Ratio	13.56							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.8 m³/sec				0.96 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	350	360	360	350	400	435	440	455
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.01	2.79	2.59	2.24	3.47	3.38	3.12	2.97
X'd Dir. Axis Transient	0.20	0.19	0.17	0.15	0.21	0.20	0.19	0.18
X"d Dir. Axis Subtransient	0.14	0.13	0.12	0.11	0.15	0.14	0.13	0.12
Xq Quad. Axis Reactance	2.57	2.39	2.22	1.92	2.92	2.84	2.62	2.49
X"q Quad. Axis Subtransient	0.36	0.33	0.31	0.27	0.41	0.40	0.37	0.35
XL Stator Leakage Reactance	0.07	0.06	0.06	0.05	0.08	0.08	0.08	0.07
X2 Negative Sequence Reactance	0.24	0.23	0.21	0.18	0.28	0.27	0.25	0.24
X0 Zero Sequence Reactance	0.10	0.09	0.09	0.07	0.10	0.09	0.09	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.61	3.35	3.11	2.69	4.17	4.05	3.75	3.56
X'd Dir. Axis Transient	0.23	0.21	0.20	0.17	0.24	0.23	0.21	0.20
X"d Dir. Axis Subtransient	0.17	0.16	0.15	0.13	0.17	0.17	0.15	0.15
Xq Quad. Axis Reactance	2.65	2.46	2.29	1.98	3.00	2.92	2.70	2.57
X"q Quad. Axis Subtransient	0.43	0.40	0.37	0.32	0.49	0.48	0.44	0.42
XL Stator Leakage Reactance	0.08	0.07	0.07	0.06	0.10	0.09	0.09	0.08
Xlr Rotor Leakage Reactance	0.12	0.11	0.10	0.09	0.13	0.13	0.12	0.11
X2 Negative Sequence Reactance	0.29	0.27	0.25	0.22	0.33	0.32	0.30	0.29
X0 Zero Sequence Reactance	0.12	0.11	0.10	0.09	0.11	0.11	0.10	0.10

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S4LID-E41 Wdg.311

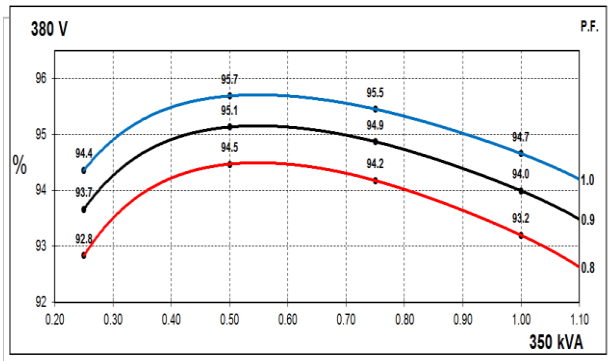
Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.08	
T''d SUB-TRANSTIME CONST.	0.019	
T'do O.C. FIELD TIME CONST.	1.7	
Ta ARMATURE TIME CONST.	0.018	
T''q SUB-TRANSTIME CONST.	0.0079	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.009	
Rotor Winding Resistance (Rf)	1.19	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
PMG Phase Resistance (Rpmg) per phase	1.9	
Positive Sequence Resistance (R1)	0.01125	
Negative Sequence Resistance (R2)	0.01296	
Zero Sequence Resistance (R0)	0.01125	
Saturation Factors	400V	480V
SG1.0	0.32	0.33
SG1.2	1.3	1.32
Mechanical Data		
Shaft and Keys	All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.	
	1 Bearing	2 Bearings
SAE Adaptor	SAE 0.5, 1	N/A
Moment of Inertia	4.6331kgm^2	N/A
Weight Wound Stator	470kg	N/A
Weight Wound Rotor	400kg	N/A
Weight Complete Alternator	1024kg	N/A
Shipping weight in a Crate	1095kg	N/A
Packing Crate Size	155 x 87 x 107 (cm)	N/A
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	N/A
Bearing Non-Drive End	Ball 6314	N/A

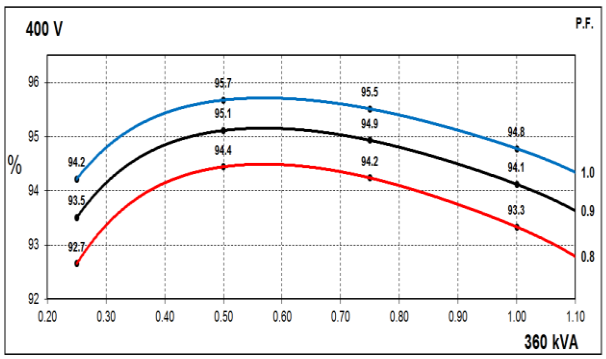
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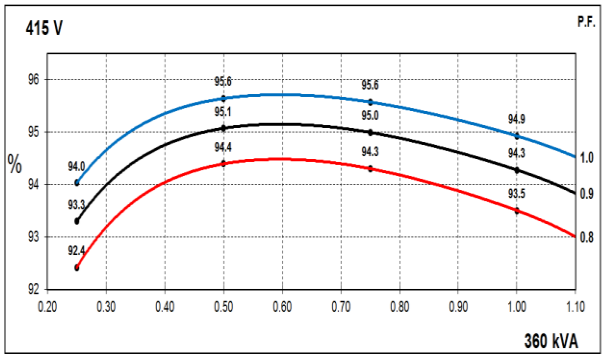
S4LID-E41 Wdg.311

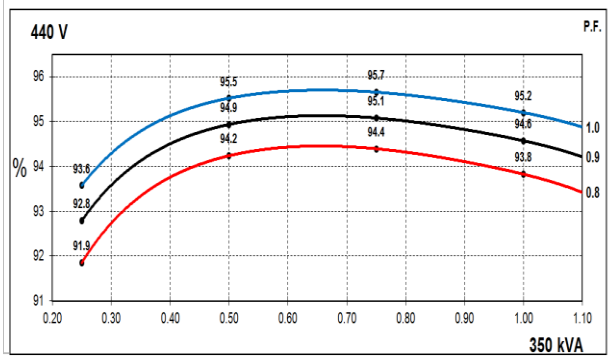
THREE PHASE EFFICIENCY CURVES

50Hz

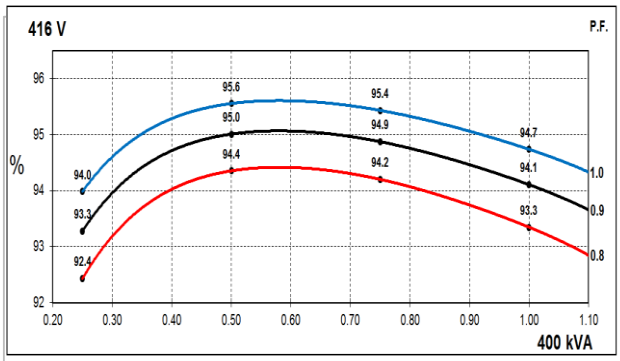


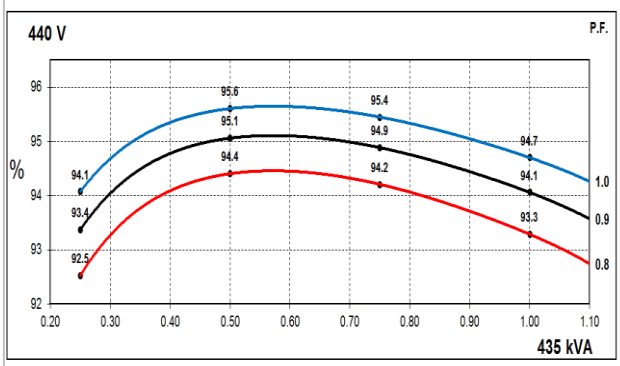


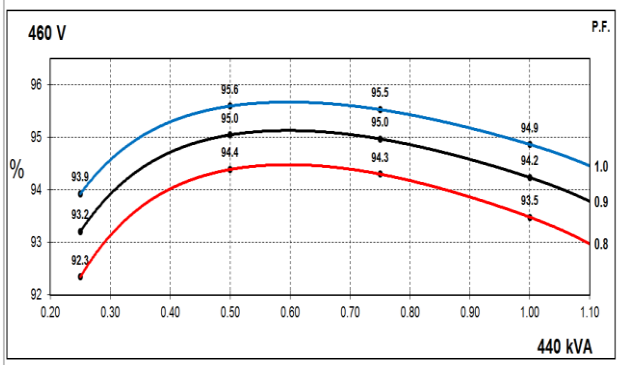


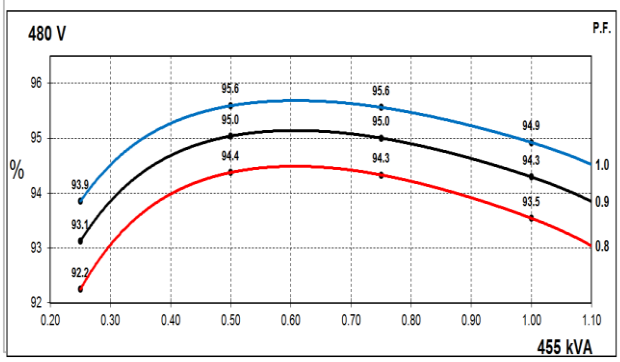


60Hz







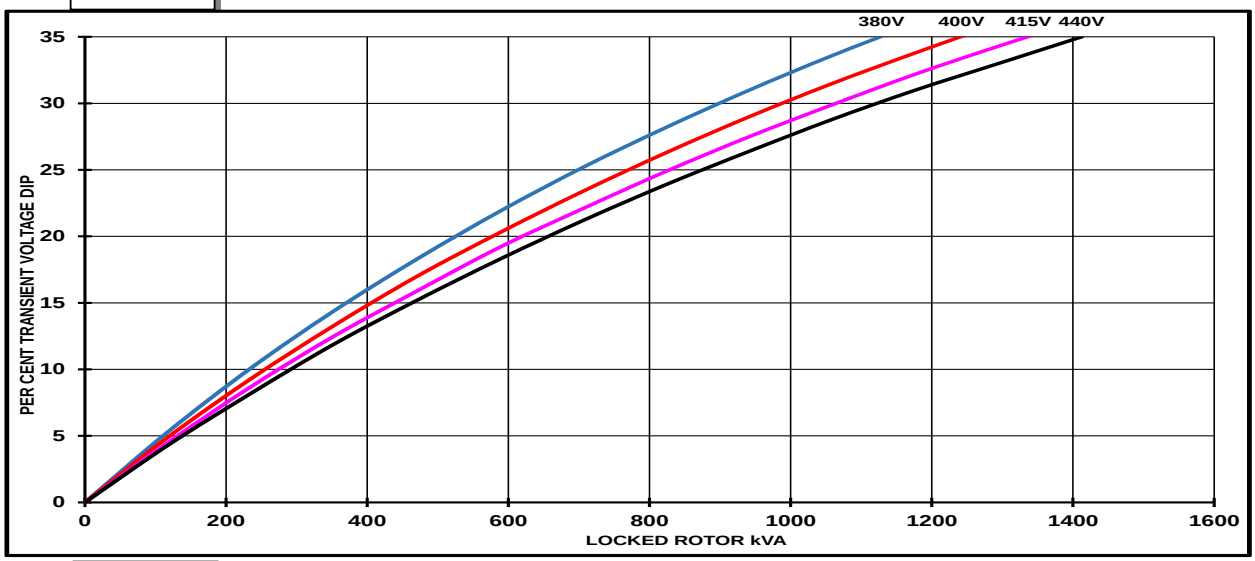


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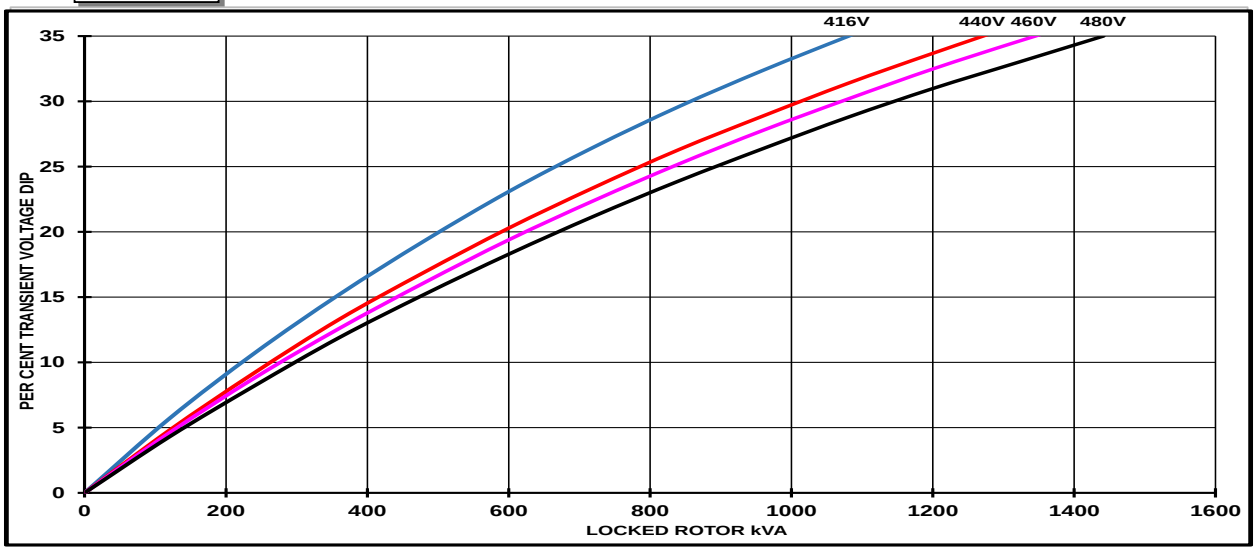
S4LID-E41 Wdg.311

Locked Rotor Motor Starting Curves - Separately Excited

50Hz



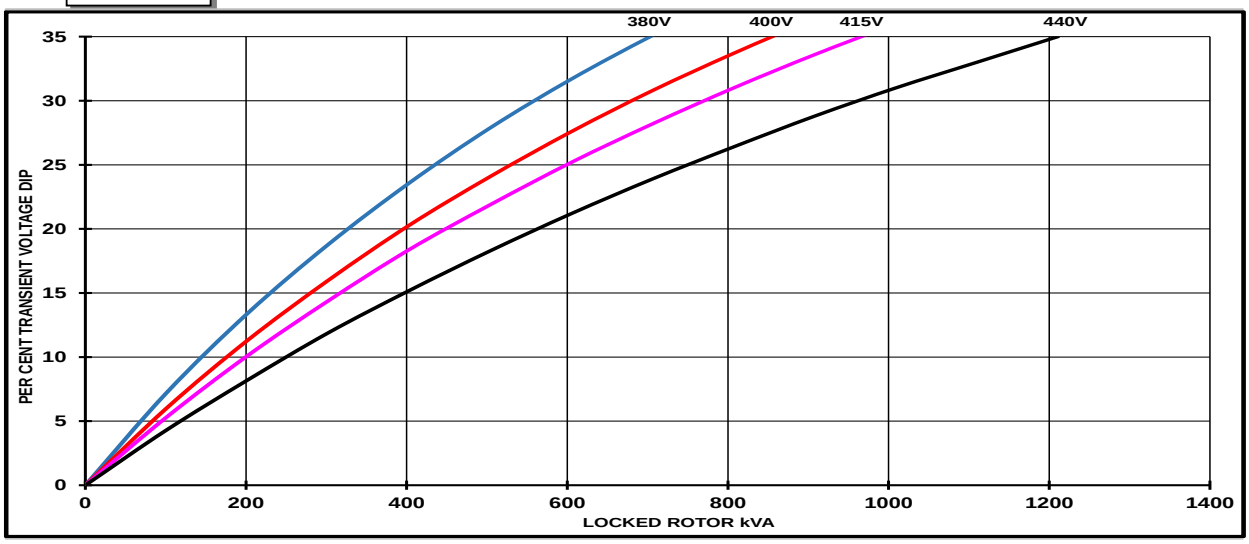
60Hz



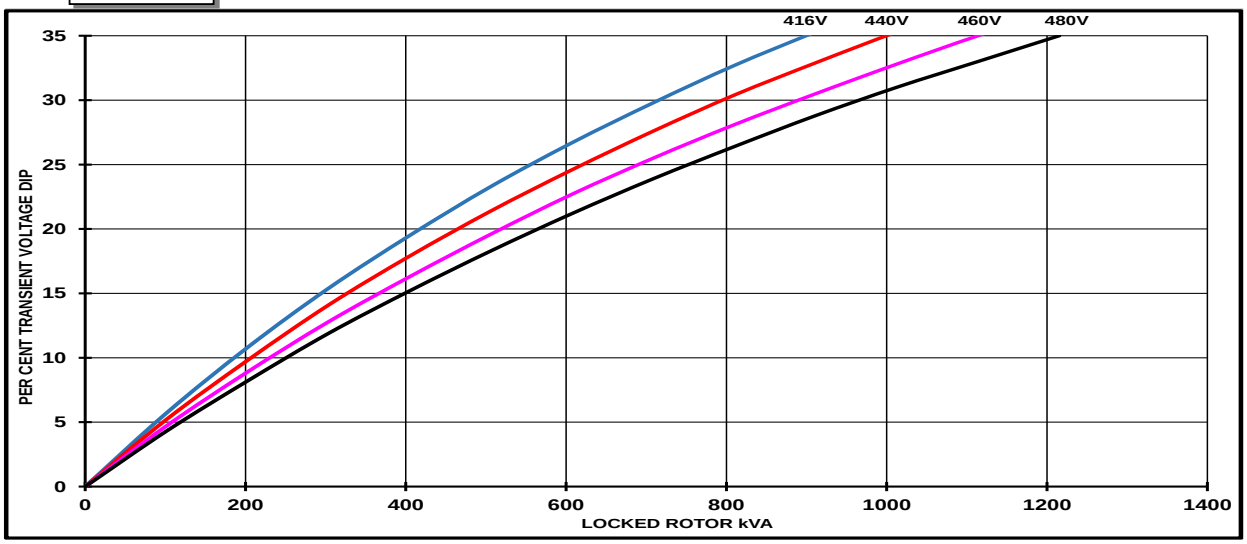
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

Locked Rotor Motor Starting Curves - Self Excited

50Hz



60Hz



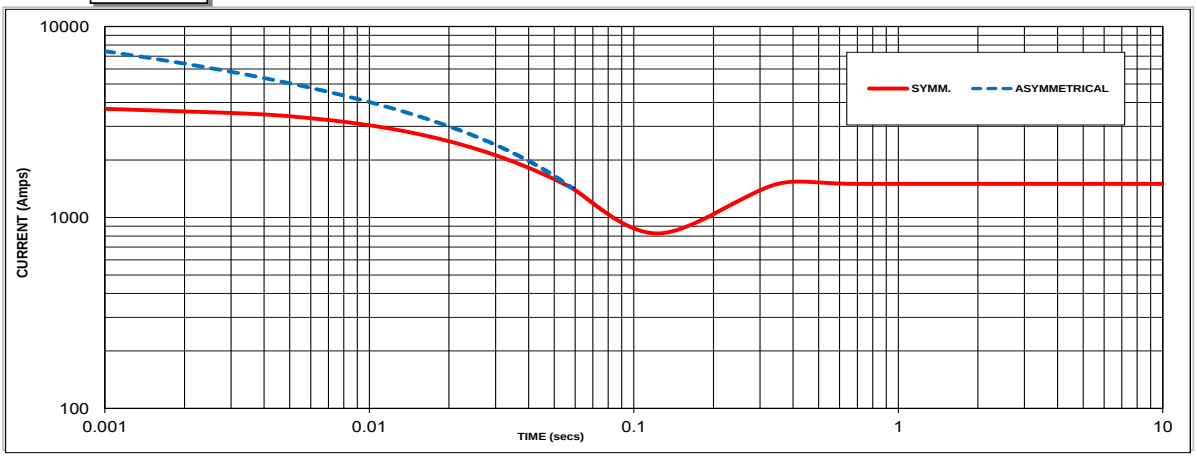
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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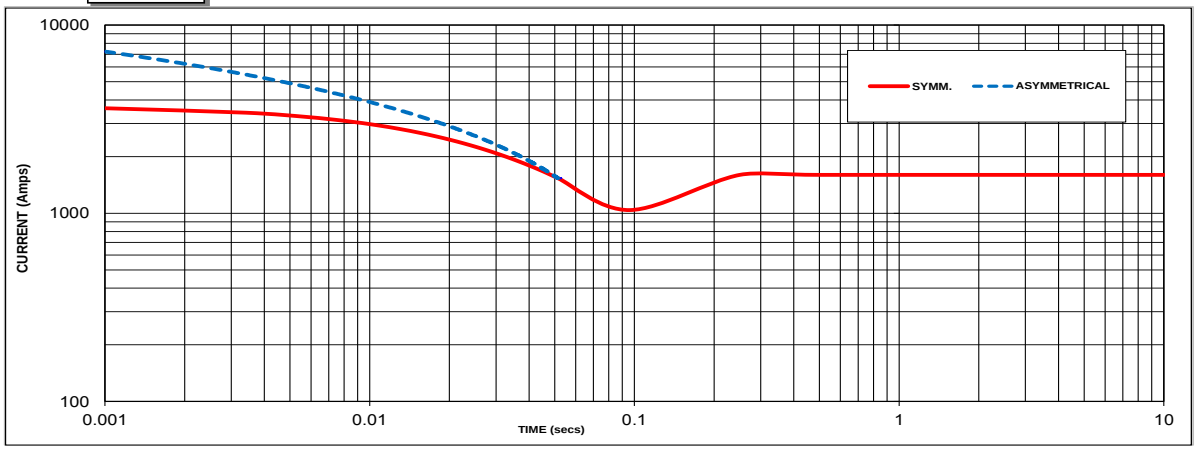
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 1500 Amps

60Hz



Sustained Short Circuit = 1600 Amps

Note 1
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380V	X 1.00	416V	X 1.00
400V	X 1.05	440V	X 1.06
415V	X 1.09	460V	X 1.10
440V	X 1.16	480V	X 1.15

The sustained current value is constant irrespective of voltage level

Note 2
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

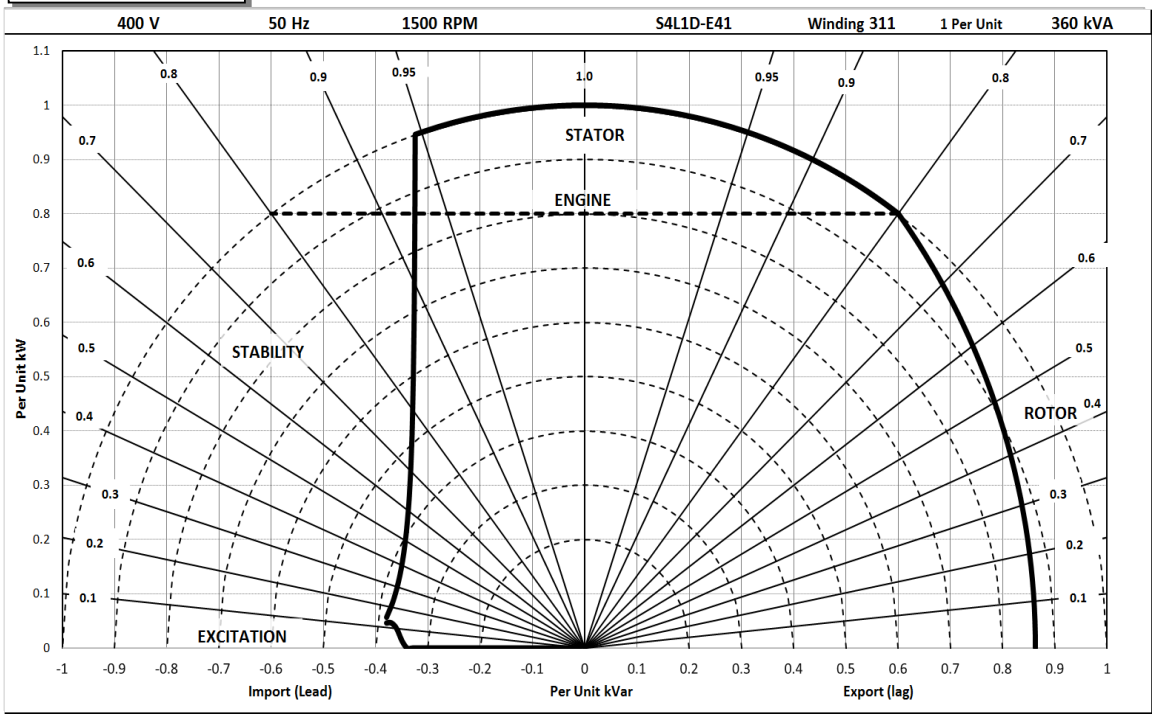
Note 3
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

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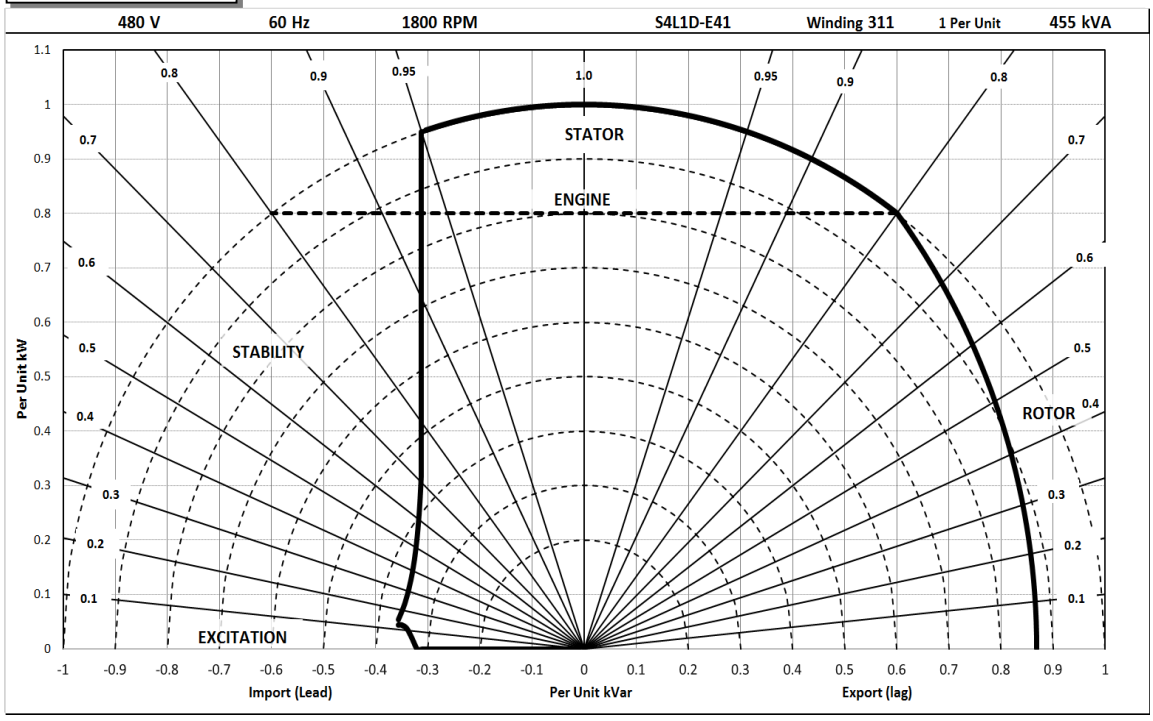
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Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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RATINGS AT 0.8 POWER FACTOR

	Class - Temp Rise	Standby - 163/27°C				Standby - 150/40°C				Cont. H - 125/40°C				Cont. F - 105/40°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	kVA	380	415	400	380	370	385	385	370	350	360	360	350	320	325	325	320
	kW	304	332	320	304	296	308	308	296	280	288	288	280	256	260	260	256
	Efficiency (%)	92.7	92.5	93.0	93.5	92.9	93.0	93.2	93.6	93.2	93.3	93.5	93.8	93.6	93.8	93.9	94.1
	kW Input	328	359	344	325	319	331	331	316	300	309	308	298	274	277	277	272

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	435	470	475	490	420	460	460	475	400	435	440	455	365	395	400	410
	kW	348	376	380	392	336	368	368	380	320	348	352	364	292	316	320	328
	Efficiency (%)	92.9	92.9	93.1	93.2	93.1	93.0	93.3	93.3	93.4	93.3	93.5	93.5	93.7	93.7	93.9	93.9
	kW Input	374	405	408	421	361	396	395	407	343	373	377	389	312	337	341	349

De-Rates

All values tabulated above are subject to the following reductions:

- 5% when air inlet filters are fitted
- 3% for every 500 meters by which the operating altitude exceeds 1000 meters above mean sea level
- 3% for every 5°C by which the operational ambient temperature exceeds 40°C
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60°C and altitude exceeding 4000 meters must be referred to applications.

Dimensional and Torsional Drawing

For dimensional and torsional information please refer to the alternator General Arrangement and rotor drawings available on our website (http://stamford-avk.com/)

Note: Continuous development of our products means that the information contained in our data sheets can change without notice, and specifications should always be confirmed with Cummins Generator Technologies prior to purchase.



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S4L1S-E4 Wdg.17 - Technical Data Sheet

Standards

STAMFORD industrial alternators meet the requirements of the relevant parts of the BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100 and AS1359. Other standards and certifications can be considered on request.

Quality Assurance

Alternators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.



Excitation and Voltage Regulators

Excitation System					
AVR Type	AS440	MX341	MX321		
Voltage Regulation	± 1%	± 1%	± 0.5%		with 4% Engine Governing
AVR Power	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	12 - 9
No Load Excitation Current (A)	0.7 - 0.5
Full Load Excitation Voltage (V)	41 - 39
Full Load Excitation Current (A)	2.3 - 2.2
Exciter Time Constant (seconds)	0.105

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S4L1S-E4 Wdg.17

Electrical Data	
Insulation System	Class H
Stator Winding	Double Layer Lap
Winding Pitch	Two Thirds
Winding Leads	12
Winding Number	17
Number of Poles	4
IP Rating	IP23
RFI Suppression	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. Refer to factory for others
Waveform Distortion	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%
Short Circuit Ratio	1/Xd
Steady State X/R Ratio	16.664
	60 Hz
Telephone Interference	TIF<50
Cooling Air	0.99 m³/sec
Voltage Star	600
kVA Base Rating (Class H) for Reactance Values	440
Saturated Values in Per Unit at Base Ratings and Voltages	
Xd Dir. Axis Synchronous	2.67
X'd Dir. Axis Transient	0.18
X"d Dir. Axis Subtransient	0.13
Xq Quad. Axis Reactance	2.24
X"q Quad. Axis Subtransient	0.31
XL Stator Leakage Reactance	0.06
X2 Negative Sequence Reactance	0.21
X0 Zero Sequence Reactance	0.07
Unsaturated Values in Per Unit at Base Ratings and Voltages	
Xd Dir. Axis Synchronous	3.20
X'd Dir. Axis Transient	0.21
X"d Dir. Axis Subtransient	0.15
Xq Quad. Axis Reactance	2.31
X"q Quad. Axis Subtransient	0.37
XL Stator Leakage Reactance	0.07
Xlr Rotor Leakage Reactance	0.10
X2 Negative Sequence Reactance	0.25
X0 Zero Sequence Reactance	0.08

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S4L1S-E4 Wdg.17

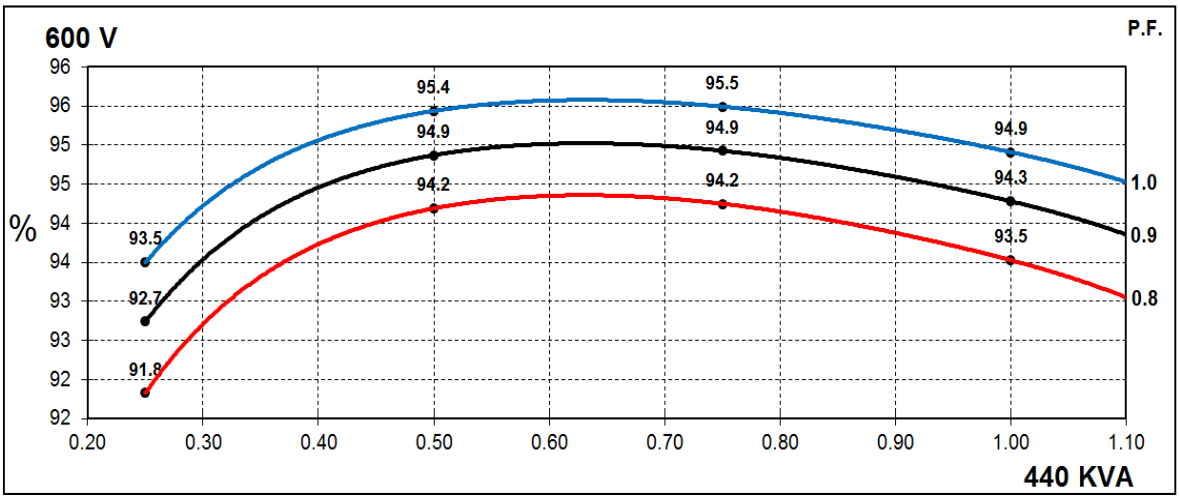
Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.08	
T''d SUB-TRANSTIME CONST.	0.019	
T'do O.C. FIELD TIME CONST.	1.7	
Ta ARMATURE TIME CONST.	0.018	
T''q SUB-TRANSTIME CONST.	0.0304	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.015	
Rotor Winding Resistance (Rf)	1.19	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
PMG Phase Resistance (Rpmg) per phase	1.9	
Positive Sequence Resistance (R1)	0.01875	
Negative Sequence Resistance (R2)	0.0216	
Zero Sequence Resistance (R0)	0.01875	
Saturation Factors	600V	
SG1.0	0.33	
SG1.2	1.62	
Mechanical Data		
Shaft and Keys	All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.	
	1 Bearing	2 Bearings
SAE Adaptor	SAE 0, 0.5, 1, 2, 3	SAE 0, 0.5, 1, 2
Moment of Inertia	4.6331 kgm^2	4.4343 kgm^2
Weight Wound Stator	470 kg	470 kg
Weight Wound Rotor	400 kg	377 kg
Weight Complete Alternator	1024 kg	1030 kg
Shipping weight in a Crate	1095 kg	1100 kg
Packing Crate Size	155 x 87 x 107 (cm)	155 x 87 x 107 (cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	Ball 6317
Bearing Non-Drive End	Ball 6314	Ball 6314

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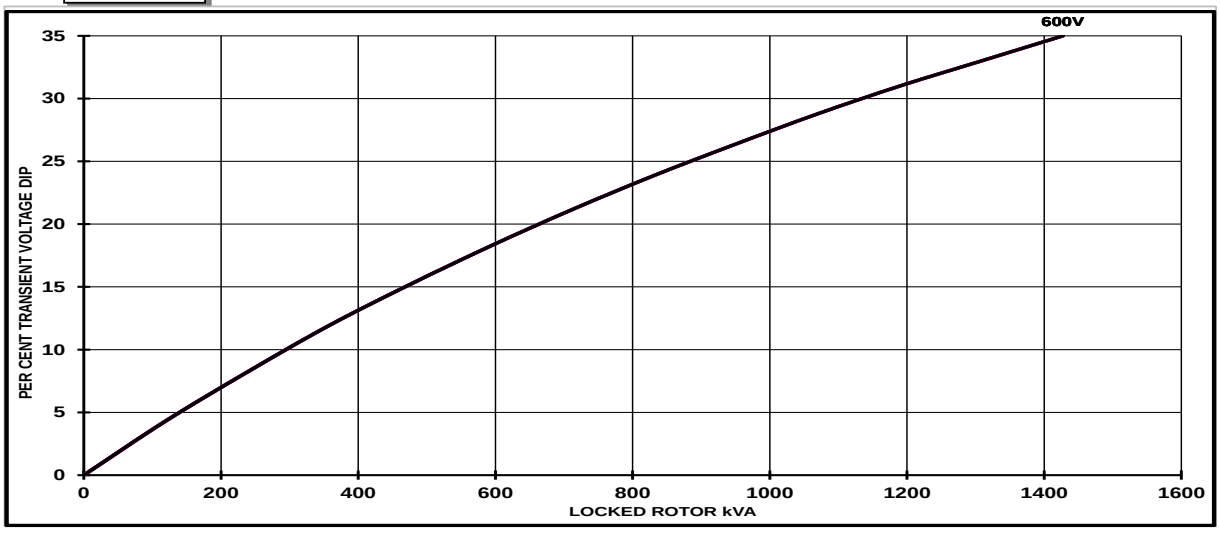
THREE PHASE EFFICIENCY CURVES

60Hz

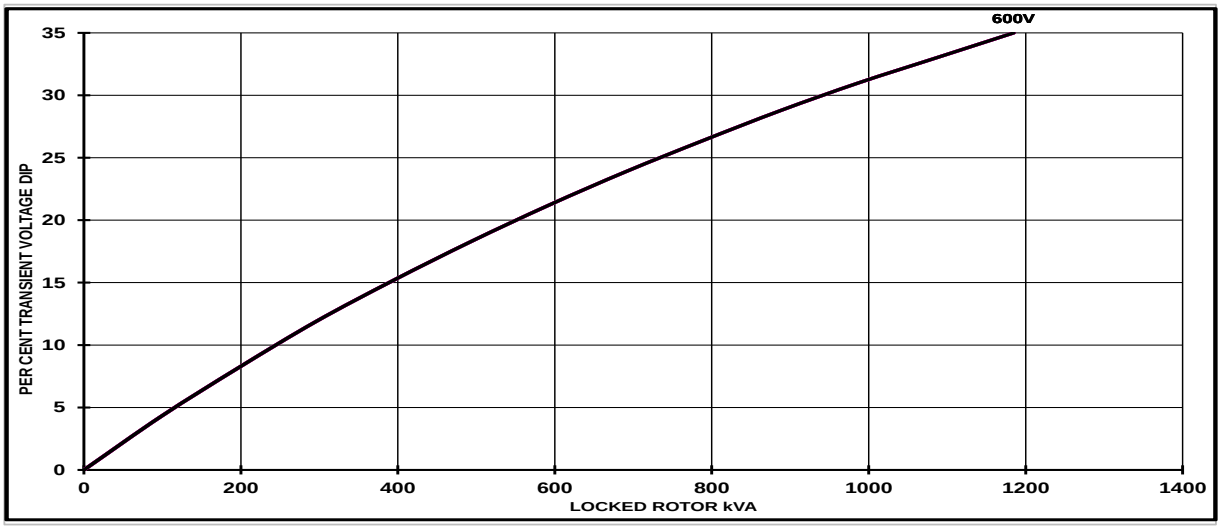


Locked Rotor Motor Starting Curves - Separately Excited

60Hz



Locked Rotor Motor Starting Curves - Self Excited

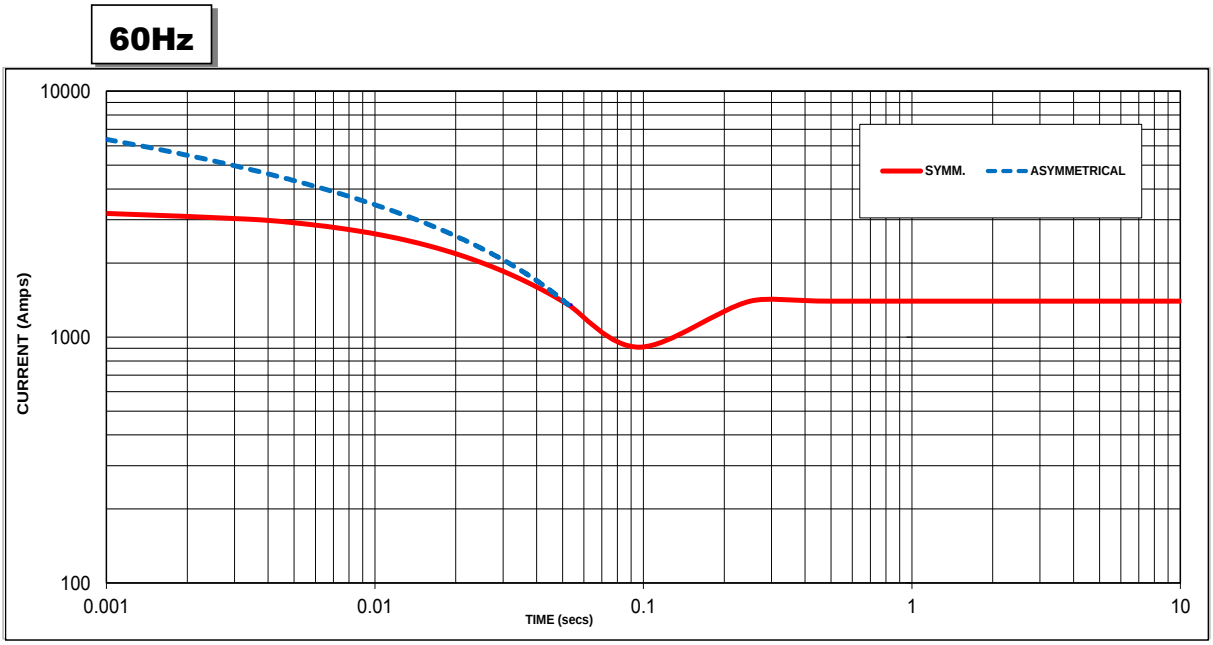


Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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S4L1S-E4 Wdg.17

Three-phase Short Circuit Decrement Curve



Sustained Short Circuit = 1400 Amps

Note 1
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

Voltage	Factor
600V	X 1.00

The sustained current value is constant irrespective of voltage level

Note 2
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

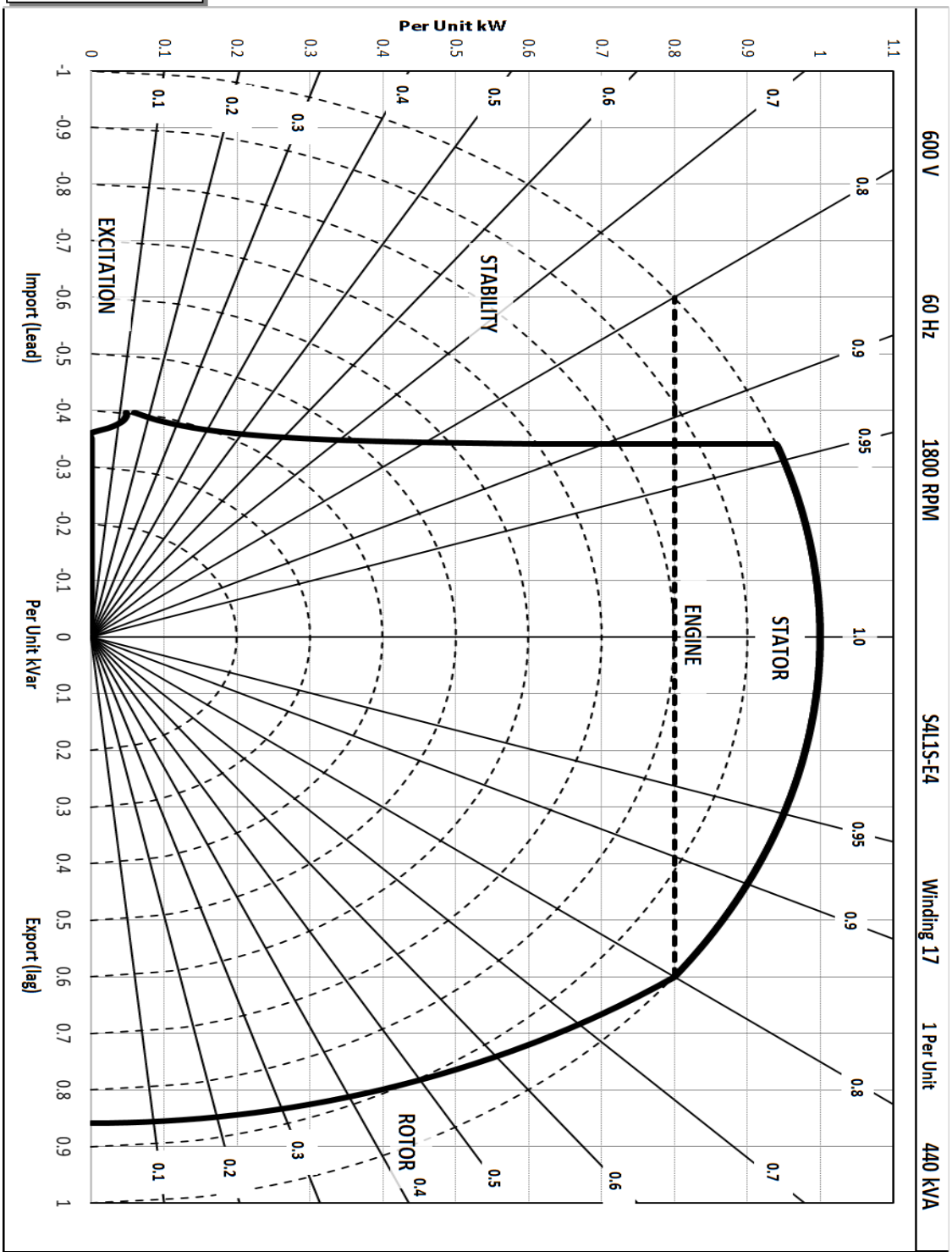
Note 3
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

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Typical Alternator Operating Charts

600V/60Hz



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S4L1S-E4 Wdg.17

RATINGS AT 0.8 POWER FACTOR

	Class - Temp Rise	Standby - 163/27°C	Standby - 150/40°C	Cont. H - 125/40°C	Cont. F - 105/40°C
60 Hz	Series Star (V)	600	600	600	600
	kVA	475	460	440	400
	kW	380	368	352	320
	Efficiency (%)	93.2	93.3	93.5	93.9
	kW Input	408	394	376	341

De-Rates

All values tabulated above are subject to the following reductions:

- 5% when air inlet filters are fitted
- 3% for every 500 meters by which the operating altitude exceeds 1000 meters above mean sea level
- 3% for every 5°C by which the operational ambient temperature exceeds 40°C
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60°C and altitude exceeding 4000 meters must be referred to applications.

Dimensional and Torsional Drawing

For dimensional and torsional information please refer to the alternator General Arrangement and rotor drawings available on our website (http://stamford-avk.com/)

Note: Continuous development of our products means that the information contained in our data sheets can change without notice, and specifications should always be confirmed with Cummins Generator Technologies prior to purchase.



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Cummins Generator Technologies



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news.stamford-avk.com

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service-engineers@stamford-avk.com

For General Enquiries:
info@cumminsgeneratortechnologies.com

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DGC-2020 Digital Genset Controller







A highly advanced integrated genset control system, this device provides genset control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.

Features

- Generator metering (includes three-phase mains)
- Engine and generator protection: 27, 32R, 40Q, 59, 81O/U
- Optional enhanced generator protection: 47, 51, 78, and 81ROCOF
- Load sharing and generator sequencing (via LSM-2020 Load Share Module)
- Var sharing over Ethernet (via LSM-2020)
- BESTCOMS*Plus*® Software
  - Programming and setup
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable logic
  - USB communications
- Automatic transfer switch control
- Automatic synchronizer (optional)
- Exercise timer
- SAE J1939 engine ECU communications
- Automatic generator configuration detection
- Expandable functionality via add-on modules
  - LSM-2020 Load Share Module
  - CEM-2020 Contact Expansion Module
  - AEM-2020 Analog Expansion Module
- Multilingual capability
- Remote communications to Basler's RDP-110 (remote display panel)
- Sixteen programmable contact inputs
- Up to 15 contact outputs: 3 contacts rated for 30 Adc and up to 12 programmable contacts rated for 2 Adc

Visit www.basler.com for additional information.

Benefits

- Provides integrated engine-genset control, protection, and metering in a single package.
- The Offline Simulator, provided in BESTlogic™*Plus*, helps test and troubleshoot logic without the need for expensive hardware.
- Flexible programmable logic and programmable I/O make it easy to expand the DGC-2020's inputs and outputs with the CEM-2020 (Contact Expansion Module) and the AEM-2020 (Analog Expansion Module). This saves time and money by eliminating unnecessary external PLCs and control relaying.

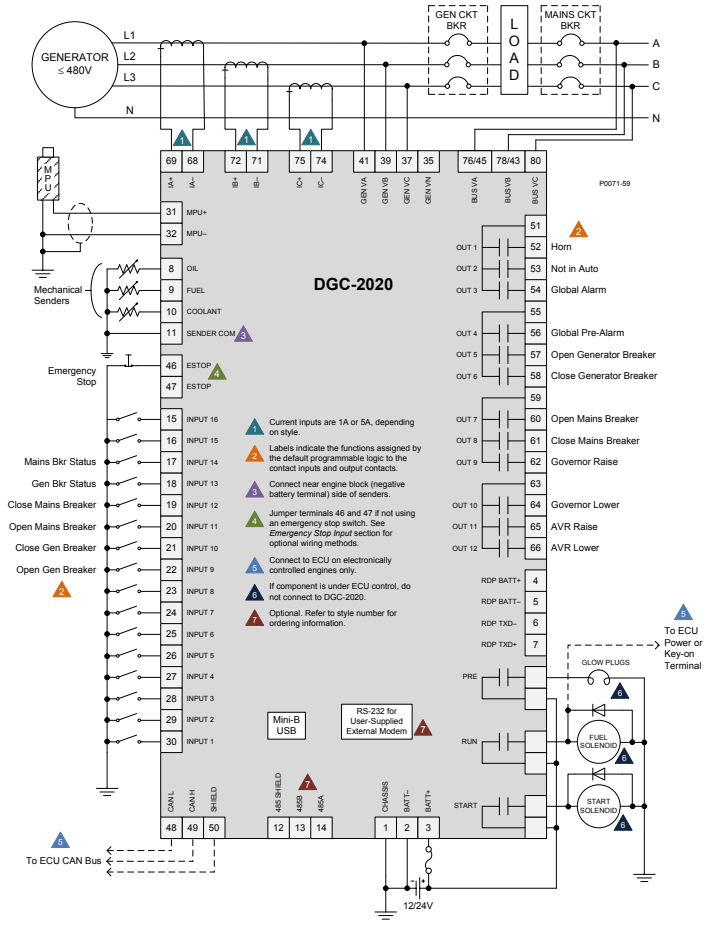


Figure 1 - DGC-2020 Connection Diagram for a Typical Application

Specifications

Power Supply

Nominal:	12 or 24 Vdc
Range:	6 to 32 Vdc
Battery Ride Through:	Starting at 10 Vdc, withstands cranking ride-through down to 0 V for 50 ms

Power Consumption

Sleep Mode:	5 W
Normal Operational Mode:	7.9 W
Maximum:	14.2 W

Current Sensing

1 A Sensing:	0.02 to 1.0 Aac, continuous 2 Aac for 1 second
5 A Sensing:	0.1 to 5.0 Aac, continuous 10 Aac for 1 second
Burden:	1 VA

Voltage Sensing

Range:	12 to 576 Vrms L-L
Frequency Range:	10 to 72 Hz for 50/60 Hz style, 10 to 480 Hz for 400 Hz style
Burden:	1 VA
One-second Rating:	720 Vrms

Contact Sensing

Contact Inputs (16):	Accepts normally open (N.O.), Dry Contacts, programmable
Emergency Stop:	Normally closed (N.C.), Dry Contact

Engine Speed Sensing

Magnetic Pickup:	
Voltage Range:	6 to 70 Vpp
Frequency Range:	32 to 10,000 Hz
Generator Frequency:	
Generator Voltage Range:	12 to 576 Vrms
Via ECU over J1939	

Resistive Senders

Fuel Level Sender:	0 to 250 Ω nominal
Coolant Temp Sender:	10 to 2,750 Ω nominal
Oil Pressure Sender:	0 to 250 Ω nominal

Output Contacts

Fuel Solenoid, Engine Crank, Pre-Start Relays Rating:	30 Adc at 28 Vdc-make, break, and carry
Programmable Relays:	Up to 12
Rating:	2 Adc at 28 Vdc-make, break, and carry

Protection

Generator:	27, 32R, 40Q, 59, 81O/U (standard) 47, 51, 78, 81 ROCOF (optional)
Engine:	Oil pressure, coolant temperature, overcrank, ECU-specific elements, and diagnostic reporting.

Agency Approvals

CSA certified, NFPA compliant, CE compliant, UL recognized (Hazardous Location certification available upon request), EAC certified

Communication

USB Port:	USB 2.0, Mini-B jack
RS-485 (optional):	9600 baud, 8 data bits, no parity
RDP-110 (optional):	4,000 ft (1,219 m) max wire length, 20 AWG (0.52 mm²) min wire size
Modem (optional):	DB-9 connector (male)
CAN bus:	250 kb/s communication rate, 1.5 to 3 Vdc differential bus

Environmental

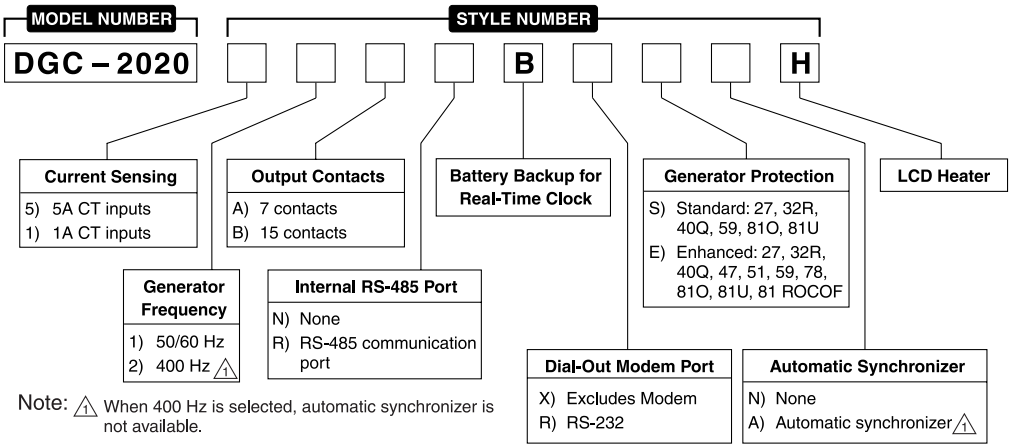
Operating Temp:	-40°C to 70°C (-40°F to 158°F)
Storage Temp:	-40°C to 85°C (-40°F to 185°F)
Humidity:	IEC 68-2-38
Salt Fog:	ASTM B 17-73, IEC 68-2-11
Ingress Protection:	IEC IP54 for front panel
Shock:	15 G in three perpendicular planes
Vibration:	
5 to 29 Hz:	1.5 G peak
29 to 52 Hz:	0.036″ (0.914 mm) double amplitude
52 to 500 Hz:	5 G peak

Physical

Weight:	4.4 lb (2 kg)
Dimensions (WxHxD):	11.77 x 8.27 x 2.69 inches (299 x 210 x 69 mm)

For complete specifications, download the instruction manual at www.basler.com.

Style Chart



Note: 1 When 400 Hz is selected, automatic synchronizer is not available.

Related Products

- BE1-11*g* Generator Protection System
  - A complete generator protection system.
- DECS-250 Digital Excitation Control System
  - Total control in a compact package provides precise voltage, var and power factor regulation, exceptional system response, and generator protection.

Accessories

- AEM-2020 Analog Expansion Module
  - Easily increases the functionality by seamlessly adding analog inputs and outputs.
- CEM-2020, CEM-2020H Contact Expansion Module
  - Each module adds 10 inputs and up to 24 outputs that are easily programmed through BESTCOMS*Plus*® for easy integration into the system.
- LSM-2020 Load Share Module
  - The simple-to-use LSM-2020 easily adds paralleling capabilities with little effort and expense.
- RDP-110 Remote Display Panel
  - Provides remote alarm and pre-alarm indication and annunciation of system status, easily meeting the annunciation requirements of NFPA-110 applications.

Tmax-Molded Case Circuit Breakers

T7 1200A Frame

AC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions	3P Fixed Version	10.55H x 8.26W x 6.06D
Weight	21.4 (lbs)	

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– "Low Voltage Directives" (LVD) no. 73/23 EEC
– "Electromagnetic Compatibility Directive" (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)	T7		
Continuous Current Rating	1200		
Number of Poles	3-4		
	S	**H**	**L**
AC			
240V	65	100	150
480V	50	65	100
600V	25	50	65

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

PR231/P, PR232/P, PR331DS, and PR332DS/P electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Padlock provision - PLL
- Direct rotary handle - RHD
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)

Publication LV114
No. 1SXU210114D0201
Printed in USA, April, 2008

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T6 800A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions	3P Fixed Version	10.55H x 8.26W x 4.07D
Weight	20.9 (lbs)	

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– "Low Voltage Directives" (LVD) no. 73/23 EEC
– "Electromagnetic Compatibility Directive" (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T6			
Continuous Current Rating		800			
Number of Poles		3-4			
		N	**S**	**H**	**L**
AC					
	240V	65	100	200	200
	480V	35	50	65	100
	600V	20	25	35	42
DC*					
	500V 2 poles in series	35	35	50	65
	600V 3 poles in series	20	20	35	50

*Thermal Magnetic Trip Only

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Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermal magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P, and PR222DS/PD-A electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)

Publication LV113
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ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T5 400A and 600A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches (400A Only)

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 8.07H x 5.51W x 4.07D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T5				
Continuous Current Rating		400-600A				
Number of Poles		3-4				
		N	**S**	**H**	**L**	**V**
AC						
240V		65	100	150	200	200
480V		25	35	65	100	150
600V		18	25	35	65	100
DC* (400 A only)						
500V	2 poles in series	25	35	50	65	100
600V	3 poles in series	16	25	35	50	65

*Thermo Magnetic Trip Only

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Mounting

Fixed
Plug-in
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermo magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit

Weight (lbs)	8.55

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

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No. 1SXU 210 039 D0201
Printed in USA, November, 2005

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Digital Linear Chargers

On-Board Chargers Today

- Current Supplier provides quality product and design services. However, services are at their pacing with limited resources; and a history of issues meeting launch dates. PC charger delays prompted a re-evaluation of our controls and processes
- Resulted in a renewed commitment to the charger category
    - Allow supplier to focus on what they do well… build product
    - All charger development controlled by Minn Kota engineering
- Minn Kota designs, tests, and qualifies
- Supplier manufactures – period
- Revised product plan
    - 2011 Digital Linear On-board chargers
    - 2012 Precision Charge On-board chargers

New Digital Linear On-Board Chargers

- Taking existing Linear On-board family of chargers and raising the bar
    - Analog to Digital designs; New “D” designation in model name

Digital± CONTROL



New Digital Linear On-Board Chargers (cont.)

- New microprocessor controlled linear design provides software enriched features and functionality
    - More repeatable set points (voltage limit and current) = improved charge curves
    - Maintenance mode time-out feature (auto-off)
    - Arc protection
    - Enhanced status codes
        - System okay
        - Charge stage indication (Bulk, Absorption, or Maintenance)
        - Full charge
        - Maintenance mode status
        - Multiple specific error indications – low battery voltage, damaged temp sensor, no output lead attached, etc.
- Up to 2X Faster Charge Times in high heat conditions

LED Status Code Detail

1. A GREEN power light is lit to indicate AC power is applied
2. A YELLOW light is lit for each bank to indicate the battery is charging in the Bulk Mode
3. A flashing YELLOW light is lit for each bank to indicate the battery is charging in the Absorption Mode
4. A flashing GREEN light is lit for each bank to indicate the battery is in maintenance mode and ready to use
5. A GREEN light is lit for each bank to indicate the battery is in long term maintenance mode and ready to use
6. A RED light for each bank is lit if any of the following apply:
    a) No battery is connected to an output cord - this may also indicate a blown fuse in the fuse holder
    b) The battery is connected reverse polarity
    c) A short circuit
    d) The battery voltage is below 4 volts - the bank will not charge a battery in this condition

LED Status Code Detail (cont.)

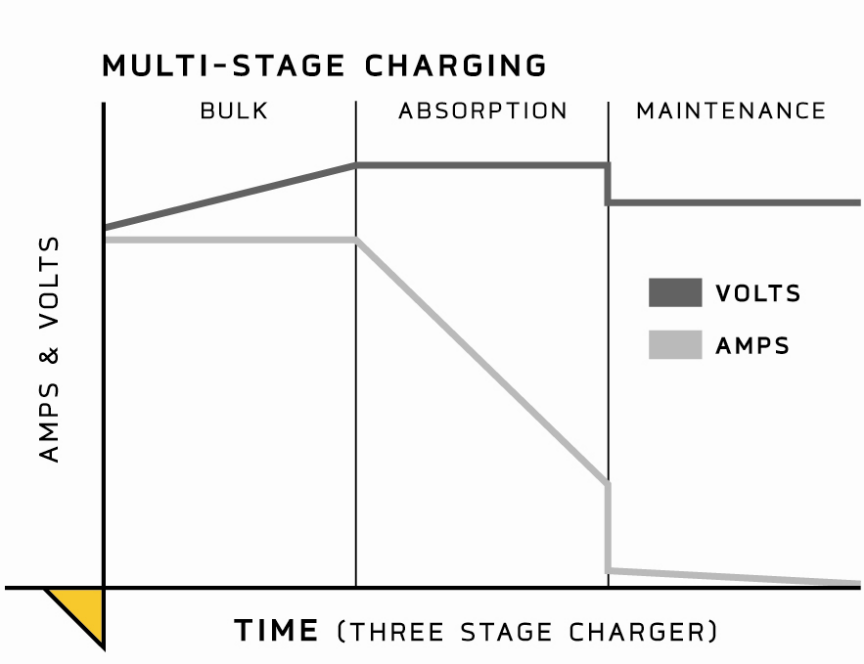
e) The battery voltage is above 18 volts - the bank will not charge a battery in this condition

7. A flashing RED light is lit for each bank if there is a damaged temperature sensor on the output cord - the bank will not operate if this occurs.
8. Flashing RED and GREEN lights are lit for each bank if any of the following apply:
   a) The battery voltage does not rise above 10.5V after 3 hours - the battery may be damaged and will not be charged
   b) Charging in Bulk Mode exceeds 20 hours - the battery may be damaged and will not be charged

Digital Linear Charging Technologies

Automatic 3-Stage Charging

- Bulk – high amps at low voltage until battery reaches ~75% charge
- Absorption – at ~75% charge, current tapers down until the battery voltage reaches 14.4V* (full charge)
- Maintenance (or Float) – when the battery voltage reaches full charge, charger output is dropped to 13.4V* (.1A-.3A). After 24 hours, the charger automatically turns off and automatically turns on when the battery voltage drops below 12.6 volts



* At 77 degrees Fahrenheit

Digital Linear Charging Technologies (cont.)

Automatic Temperature Compensation

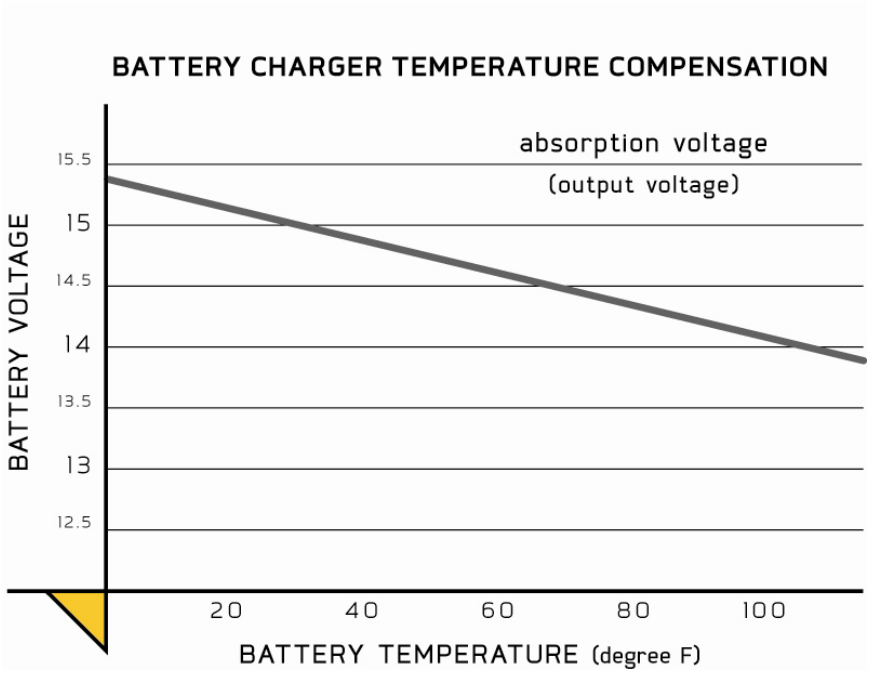
- Senses temperature and adjusts output voltage
- Protects batteries from overcharging at high temperatures
- Maintains gassing threshold for a full charge

Gassing Threshold

- Voltage level at which electrolyte begins moving within the battery
- This threshold must be reached in order to fully charge a battery

Effect of Temperature

- Gassing threshold is higher at lower temps, lower at higher temps
- Too much voltage at high temperatures can “boil” and destroy a battery



Digital Linear Chargers

Specifications

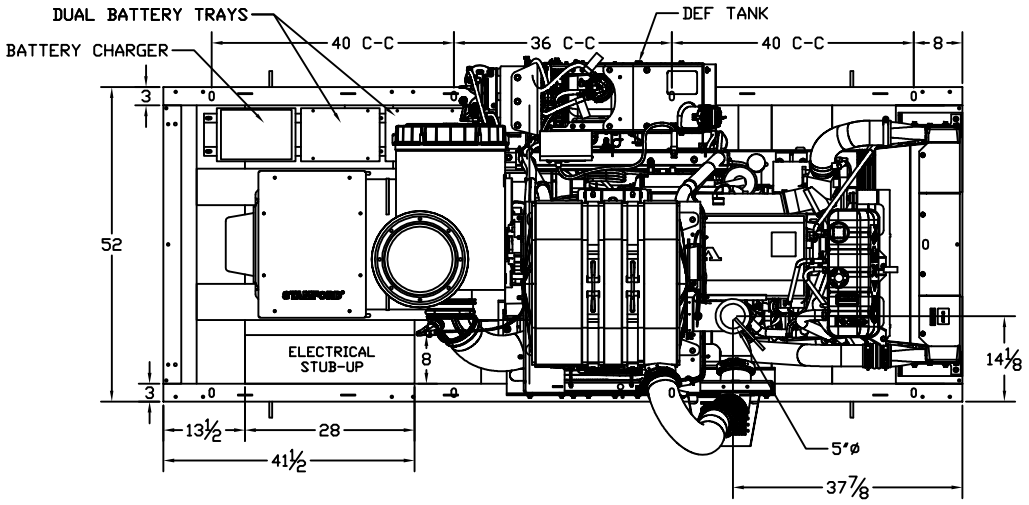
- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant
- UL listed to marine standard 1236
- 3 year warranty
- Replaces all existing current on-board chargers (excluding portables)
- No Price Increase
- Availability: November 2010

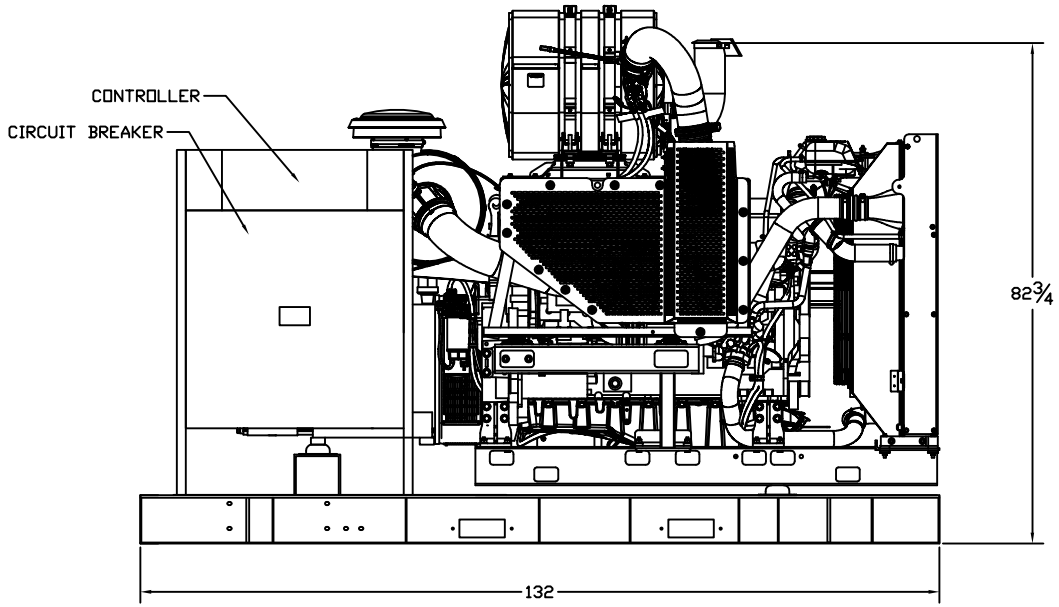


DIGITAL LINEAR ON-BOARD CHARGERS	
PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 amps)
1822305	MK-230D (2 bank x 15 amps)
1823455	MK-345D (3 bank x 15 amps)
1824605	MK-460D (4 bank x 15 amps)

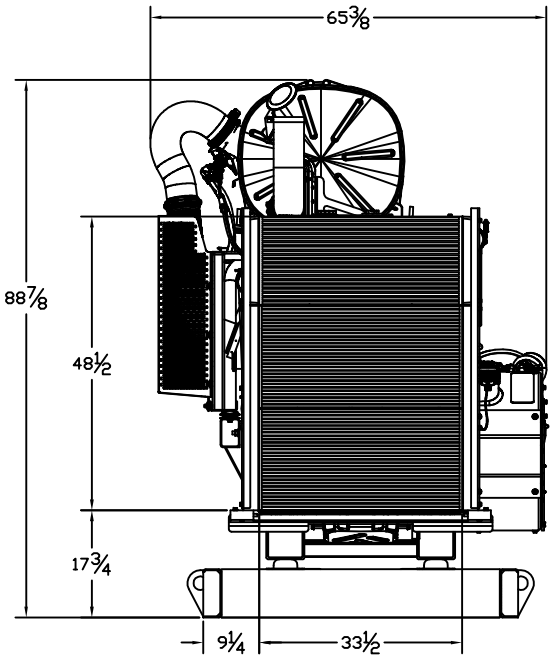
OUTLINE DIMENSIONS FOR T4D-3000 OPEN

TOP VIEW





SIDE VIEW

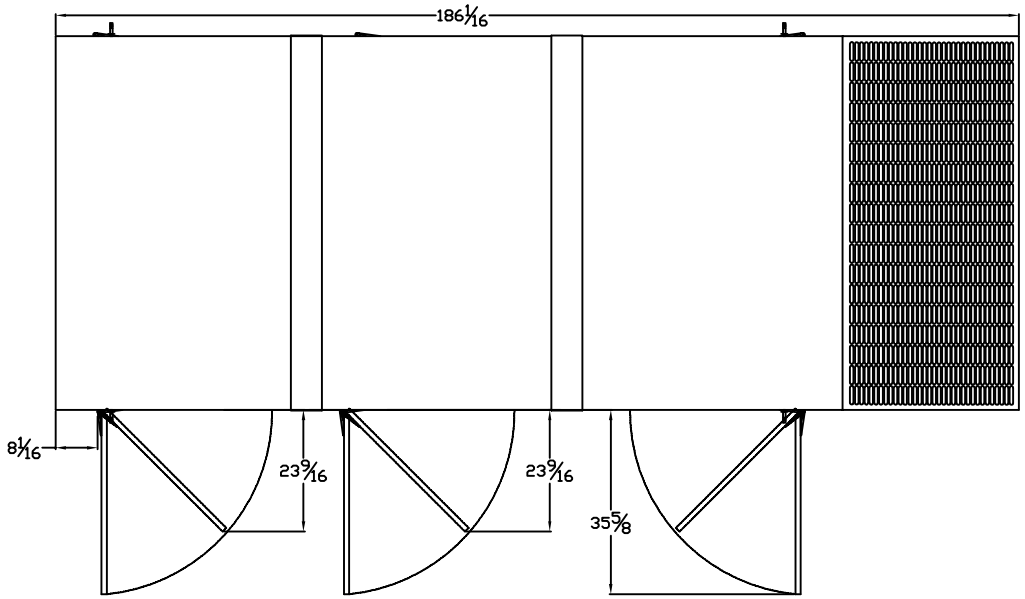


RADIATOR END VIEW

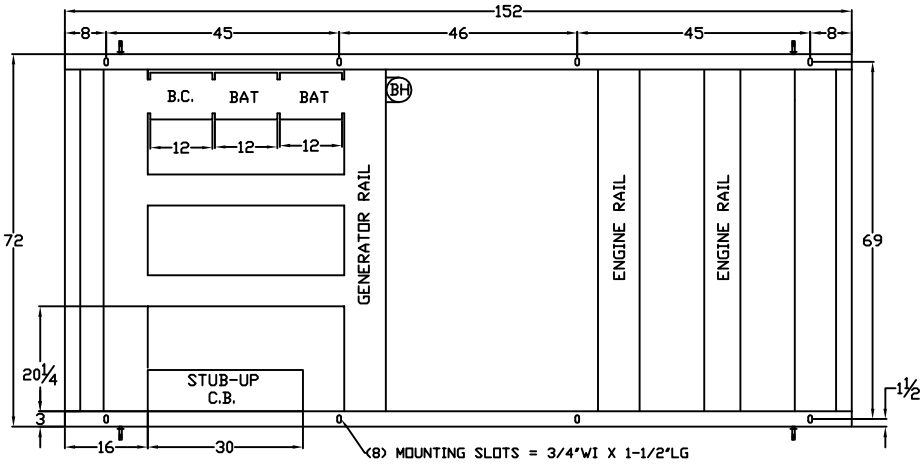
OUTLINE DIMENSIONS FOR T4D 250-400 KW LEVEL 2 ENCLOSURE

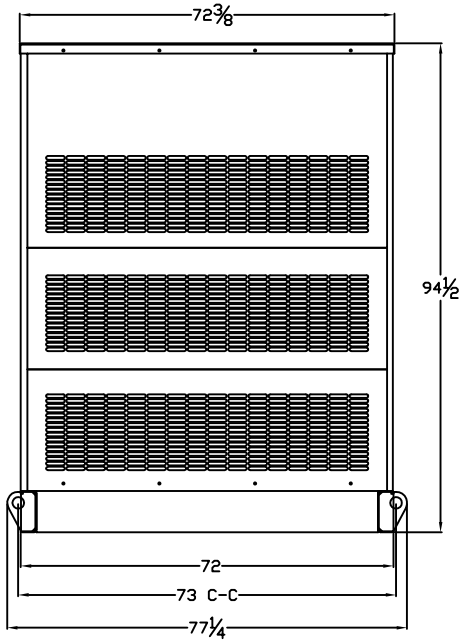
TOP VIEW

(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)

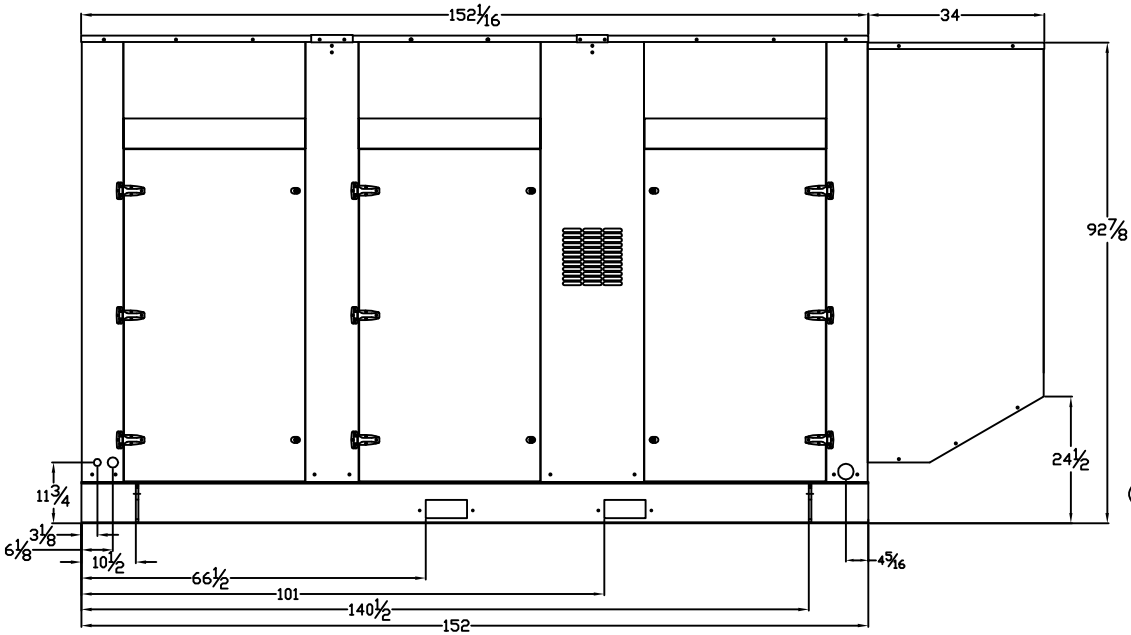


FRAME VIEW

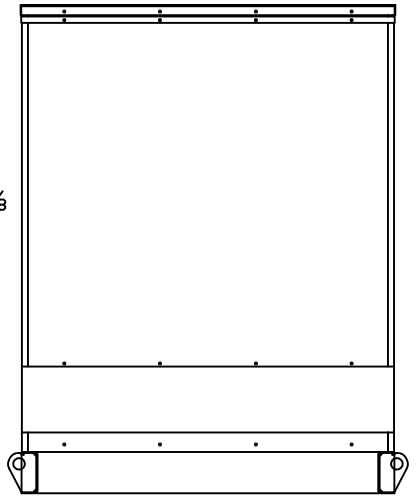




GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW

GILLETTE GENERATORS

LIQUID COOLED DIESEL ENGINE GENERATOR SET

60 HZ MODEL

T4D-6000

Model	HZ	STANDBY 130ºC RISE	PRIME 105ºC RISE
T4D-6000-60 HERTZ	60	600	570

All generator sets are USA prototype built and thoroughly tested. Production models are USA factory built and 100% load tested.

UL1446, UL508, UL142, UL498

NFPA 110, 99, 70, 37
All generator sets meet NFPA-110 Level 1, when equipped with the necessary accessories and installed per NFPA standards.

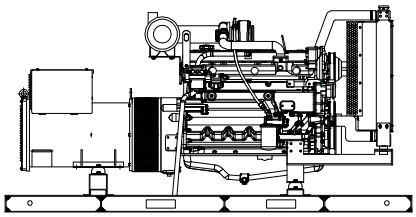
NEC 700, 701, 702, 708

NEMA ICS10, MG1, ICS6, AB1

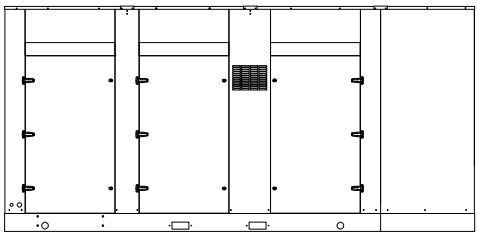
ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05

ASCE 7-05 & 7-10
All generator sets meet 180 MPH rating.

EPA 40CFR Part 60, 89, 1039, 1048, 1054, 1065, 1068



"OPEN" GEN-SET
There is no enclosure, so gen-set must be placed within a weather protected area, un-inhabited by humans or animals, with proper ventilation. Silencer not supplied, as installation requirements are not known. However, this item is available as optional equipment.



"LEVEL 2" HOUSED GEN-SET
Full aluminum weather protection and superior sound attenuation for specific low noise applications. Critical grade muffler is standard.

GENERATOR RATINGS

GENERATOR MODEL	VOLTAGE		PH	HZ	130ºC RISE STANDBY RATING		105ºC RISE PRIME RATING	
	L-N	L-L			KW/KVA	AMP	KW/KVA	AMP
T4D-6000-3-2	120	208	3	60	600/750	2084	570/712	1980
T4D-6000-3-3	120	240	3	60	600/750	1806	570/712	1716
T4D-6000-3-4	277	480	3	60	600/750	903	570/712	858
T4D-6000-3-5	127	220	3	60	600/750	1970	570/712	1872
T4D-6000-3-16	346	600	3	60	600/750	722	570/712	686

RATINGS: All three phase gen-sets are 12 lead windings, rated at .8 power factor. 130° C "STANDBY RATINGS" are strictly for gen-sets that are used for back-up emergency power to a failed normal utility power source. This standby rating allows varying loads, with no overload capability, for the entire duration of utility power outage. 105° C "PRIME RATINGS" are strictly for gen-sets that provide the prime source of electric power, where normal utility power is unavailable or unreliable. A 10% overload is allowed for a total of 1 hour, within every 12 hours of operation, on every PRIME RATED systems. All gen-set power ratings are based on temperature rise measured by resistance method as defined by MIL-STD 705C and IEEE STD 115, METHOD 6.4.4. All generators have class H (180°C) insulation system on both rotor and stator windings. All factory tests and KW/KVA charts shown above are based 130°C (standby), and 105°C (prime) R/R winding temperature, within a maximum 40°C ambient condition. Generators operated at standby power ratings must not exceed the temperature rise limitation for class H insulation system, as specified in NEMA MG1-22.40. Specifications & ratings are subject to change without prior notice.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-6000-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer ..... Stamford Generators
Model & Type ..... HCI634G-311, 4 Pole, 12 Lead, Three Phase
..... HCI534F-311, 4 Pole, 12 Lead, 480V, Three Phase
..... HCI534F-17, 4 Pole, 12 Lead, 600V, Three Phase
Exciter ..... Brushless, shunt excited
Voltage Regulator ..... Solid State, HZ/Volts
Voltage Regulation ..... ½%, No load to full load
Frequency ..... 60 HZ
Frequency Regulation ..... ± ½% (1/2 cycle, no load to full load)
Unbalanced Load Capability ..... 100% of standby amps
One Step Load Acceptance ..... 100% of nameplate rating
Total Stator and Load Insulation ..... Class H, 180°C
Temperature Rise ..... 105°C R/R, prime rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V) ... 1500 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V-600V) 2300 kVA
Bearing ..... 1, Pre-lubed and sealed
Coupling ..... Direct flexible disc.
Total Harmonic Distortion ..... Max 3½% (MIL-STD705B)
Telephone Interference Factor ..... Max 50 (NEMA MG1-22)
Deviation Factor ..... Max 5% (MIL-STD 405B)
Alternator ..... Self ventilating and drip-proof
Ltd. Warranty Period ..... 24 Months from start-up date or
..... 1000 hours use, first to occur.

GENERATOR FEATURES

- World Renown Stamford Electric Generator having UL-1446 certification.
- Full generator protection with **Basler DGC-2020** controller, having UL-508 certification.
- Automatic voltage regulator with over-excitation, under-frequency compensation, under-speed protection, and EMI filtering. Entire solid-state board is encapsulated for moisture protection.
- Generator power ratings are based on temperature rise, measured by resistance method, as defined in MIL-STD 705C and IEEE STD 115, Method 6.4.4.
- Power ratings will not exceed temperature rise limitation for class H insulation as per NEMA MG1-22.40.
- Insulation resistance to ground, exceeds 1.5 meg-ohm.
- Stator receives 2000 V. hi-potential test on main windings, and rotor windings receive a 1500 V. hi-potential test, as per MIL-STD 705B.
- Full amortisseur windings with UL-1446 certification.
- Complete engine-generator torsional acceptance, confirmed during initial prototype testing.
- Full load testing on all engine-generator sets, before shipping.

ENGINE SPECIFICATIONS AND APPLICATIONS DATA

ENGINE

Manufacturer ..... VOLVO-PENTA
Model and Type ..... TWD1673GE, 4 cycle, liquid Cooled
Aspiration ..... Turbo After Cooler, H2O to Air
Charged Air Cooled System ..... H2O to Air
Cylinder Arrangement ..... 6 Cylinders, In-Line
Displacement Cu. In. (Liters) 984 (16.1)
Bore & Stroke in (Cm) ..... 5.67 x 6.50 (14.4 x 16.5)
Compression Ratio 16.8:1
Main Bearings ..... Tin Overlay with Babbit Backing
Cylinder Head ..... Cast Iron with overhead Cam
Pistons ..... Aluminum Alloy with Graphite Coating
Crankshaft ..... Induction Hardened, Heat Treated Forged
Valves ..... Heat Treated and Hardened Exhaust Valve
Governor ..... Electronic, EMS 2.2
Frequency Regulation ..... ± 1/4%
Air Cleaner ..... Dry, Replaceable Cartridge
Engine Speed ..... 1800 rpm
Max Power, bhp (kwm) Standby 932 (695)
Max Power, bhp (kwm) Prime 850 (625)
BMEP: psi (MPa) Standby 411 (2.8)
Ltd. Warranty Period ..... 2 Year or 1000 hrs, first to occur

FUEL SYSTEM

Type ..... Diesel Fuel Oil (ASTM No. 2-D)
Combustion System ..... Direct Injection
Fuel Injection Pump ..... Electronic, Delphi E3
24 VDC Coolant heaters ..... Optional Equipment
Fuel Filter .... Yes with Water Separator

FUEL CONSUMPTION

GAL/HR (LITER/HR)	STANDBY	PRIME
100% LOAD	42.8 (162)	40.1 (152)
75% LOAD	29.7 (112)	26.9 (101)
50% LOAD	20.0 (75.7)	18.3 (69.3)

OIL SYSTEM

Type ..... Full Pressure
Oil Pan Capacity qt. (L) 50.7 (48)
Oil Pan Cap. W/ filter qt. (L) 44.3 (42)
Oil Filter ..... 3, Replaceable Cartridge type

ELECTRICAL SYSTEM

Ignition System ..... Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 110 amp/hr.

Recommended battery to -18°C (0° F): ....(2) 12 VDC, BCI# 31, Max. Dimensions: 14"lg x 6 3/4" wi x 10" hi, with standard round posts. Min output 1000 CCA. Battery tray (max. dim. at 15"lg x 7"wi). This model has (2) battery trays, (2) hold down straps, (2) sets of battery cables, and (1) battery charger. Installation of (2) 12VDC starting batteries connected in series for 24VDC output is required, with possible higher AMP/HR rating, as described above, if the normal environment temperature averages -13° F (-25°C) or cooler.

CERTIFICATIONS

All engines are EPA emissions certified. All non-emergency stationary diesel engines are Tier IV Final compliant.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-6000-60 HZ

COOLING SYSTEM

Type of System ..... Air to Air, Charged Air Cooler
Coolant Pump .....Pre-lubricated, self-sealing
Cooling Fan Type .....Pusher
Fan Diameter inches (cm).....35.1 (89)
Fan drive ratio..... 1.04:1
Ambient Capacity of Radiator °F (°C).....131 (55)
Engine Jacket Coolant Capacity gal. (L).....8.70 (33)
Radiator Coolant Capacity gal. (L) 16.0 (60)
Water Pump Capacity gpm (L/min)..... .....122 (462)
Heat Reject Coolant: Btu/min ....….12,682
Air to Air Heat Reject, BTU/min. ....….11,715
Heat Radiated to Ambient, BTU/min .... ….4,253
Low Radiator Coolant Level Shutdown……..Standard
Note: Coolant temp. shut-down switch setting at 228°F (109°C) with 50/50 (water/antifreeze) mix.

COOLING AIR REQUIREMENTS

Combustion Air cfm (m^3/min) 1,646 (46.6)
Max Air Intake Restrictions:
Clean Air Cleaner, KPA (psi) 5 (1.5)
Radiator Cooling Air, SCFM (m^3/min)……....29,894 (846)

EXHAUST SYSTEM

Exhaust Outlet Size.....10"
Max. Back Pressure in KPA (in. H2O).....10 (40)
Exhaust Flow, at rated KW, CFM (m3/min)..... 4,347 (123)
Exhaust Temp, (Stack) °F (ºC) 932 (500)

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, SCR/Residential Silencer	98	83

Note: Open sets (no enclosure) have installed selective catalytic reduction/residential silencer system. Level 2 enclosure has installed selective catalytic reduction/residential silencer. Sound tests are averaged from several test points and taken at 23 ft. (7 m) from source of noise at normal operation.

DERATE GENERATOR FOR ALTITUDE

3% per 1000 ft. (305m) above 3000 ft. (914m) from sea level

DERATE GENERATOR FOR TEMPERATURE

2% per 10°F (5.6°C) above 104°F (40°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm)	152 (368)	200 (508)
Width in (cm)	72 (183)	72 (183)
Height in (cm)	116 (295)	94 (239)
3 Ø Net Weight lbs (kg)	9625 (4366)	14975 (6793)
3 Ø Ship Weight lbs (kg)	10025 (4547)	15375 (6974)

BASLER DGC-2020 DIGITAL MICROPROCESSOR CONTROLLER



Basler DGC-2020

The "**2020**" controller is a highly advanced integrated gen-set control system for single gen-set applications. This controller includes a backlit LCD display which continuously displays the status of the engine and generator at all times.

Basler "**DGC-2020"** includes: Generator metering (including three phase) • Engine – Generator protections including IEEE-[27] under voltage, [32] power, [40] loss of excitation, [59] over voltage, [81] over and under frequency, Exercise timer • SAE J1939 engine ECU communications • Expansion capabilities for both inputs and outputs with expansion • Remote communications through RS-485 to Basler's RDP110 remote Display panel • (16) programmable contact inputs • (15) programmable contact outputs- (3) for up to 30AmpDC and (12) for up to 2 Amp DC • Illuminated Text Display • Front panel menu scroll buttons • Front panel operation mode buttons for STOP, RUN and AUTO • Alarm Silence and Lamp Test buttons

This controller includes expansion features including, RS485 (using MODBUS), direct USB connection with PC, expansion optioned using BESTCOMSPlus for remote annunciation and remote relay interfacing for a distance of up to 3300FT. The controller software is freely downloadable from the internet and allows monitoring with direct USB cable, LAN, or by internet via the built in web interface.



Further expansion is available by adding the optional RDP-110 remote display panel module. This featured device will allow Four programmable LEDs (2) alarms and (2) pre-alarms • (17) alarms and pre-alarms displayed from Basler controller • audible alarm horn • lamp test and alarm silence buttons • RD100 local power supply inputs of either 12vdc or 24vdc • connects through Basler controller through RS-485 communications protocol • conduit box included for (2) mounting configurations- either surface mount or semi-flush mounting.

STANDARD FEATURES FOR MODEL T4D-6000-60 HZ

STANDARD FEATURES

CONTROL PANEL:

Basler DGC-2020 digital microprocessor with logic allows programming in the field. Controller has:

- STOP-MANUAL-AUTO modes and automatic engine shutdowns, signaled by full text LCD indicators:
- Low oil pressure
- High engine temp
- Low Radiator Level
- Three auxiliary alarms
- Battery fail alarm
- Engine fail to start
- Engine over speed
- Engine under speed
- Over & under voltage

Also included is tamper-proof engine hour meter

ENGINE:

Fuel filter • Full flow Oil filter • Air filter • Fuel pump • Oil pump • Solenoid type starter motor • Hi-temp radiator • Jacket water pump • Thermostat • Pusher fan and guard • Exhaust manifold • Electronic Governor • 24 VDC battery charging alternator • Flexible fuel and exhaust connectors • Vibration isolators • Open coolant recovery system with 50/50 water to anti-freeze mixture • flexible oil & radiator hose • Shut-down sensors for low oil pressure, high coolant temp., low coolant level, high ambient temp.

Design & specifications subject to change without prior notice. Dimensions shown are approximate. Contact Gillette for certified drawings. DO NOT USE DIMENSIONS FOR INSTALLATION PURPOSES.

AC GENERATOR SYSTEM:

AC generator • Shunt excited • Brushless design • Circuit Breaker installed and wired to gen-set • Direct connection to engine with flex disc • Class H, 180°C insulation • Self ventilated • Drip proof construction • UL Certified

VOLTAGE REGULATOR:

1% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

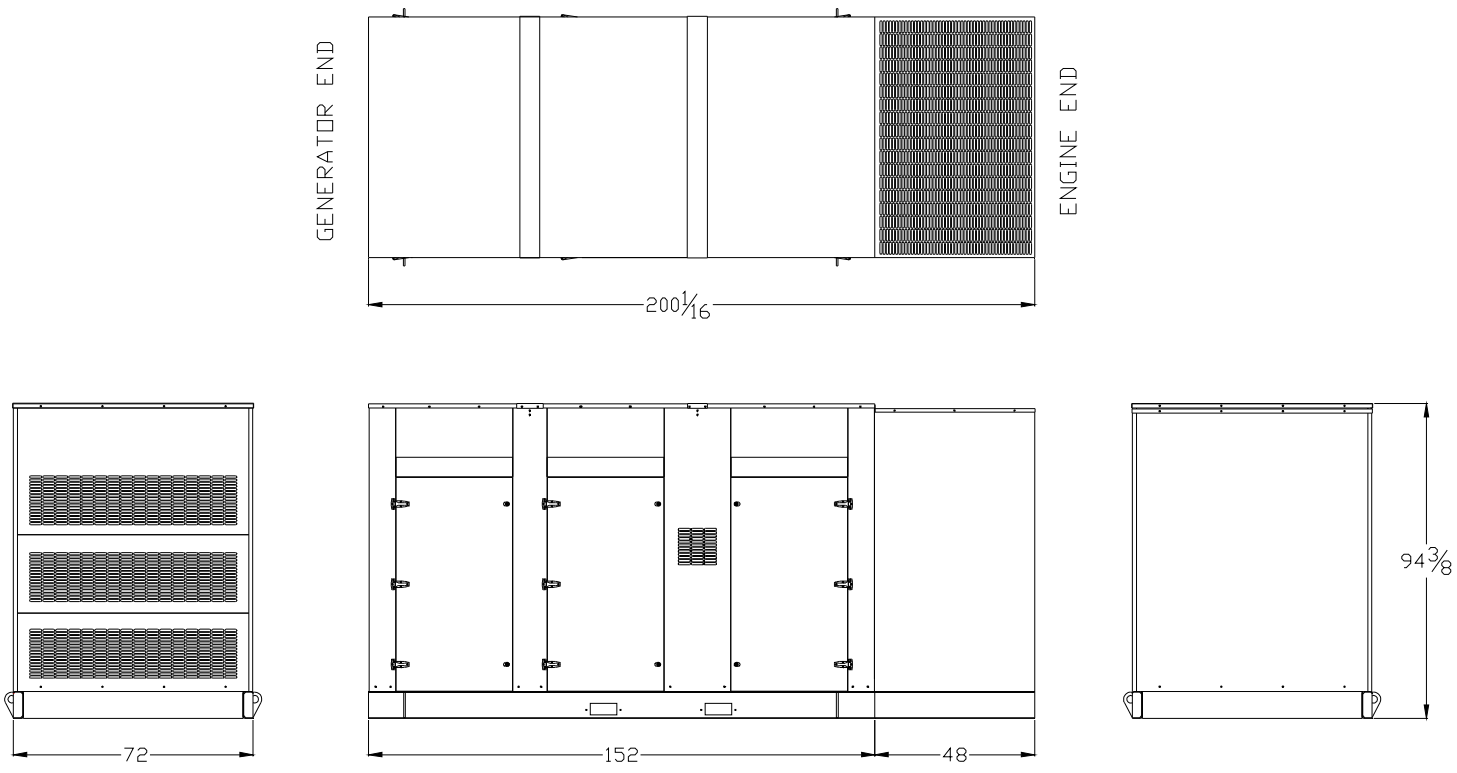
DC ELECTRICAL SYSTEM:

Battery trays • Battery cables • Battery hold down straps • 3-stage battery charger with float, absorption, & bulk automatic charge stages

WEATHER / SOUNDPROOF ALUMINUM HOUSING:

Corrosion Resistant Protection consisting of:

- (9) Heated and Agitated Wash Stages
- Zinc Phosphate Etching-Coating Stage
- Final Baked on Enamel Powder Coat
- 18/8 Stainless Steel Hardware



TWD1672-1673GE

615 kW (836 hp) & 685 (932) at 1800 rpm, acc. to ISO 3046

US EPA & CARB Tier 4 Final



A powerful, reliable and economical generating set diesel engine range built on the proven Volvo Group in-line six concept.

Powerful package

High power density in a compact package with dual stage turbo charging. Excellent load step performance according to ISO 8528-5.

Low cost of ownership & operation

World class fuel efficiency in combination with a proven and reliable engine and exhaust aftertreatment system design. The exhaust aftertreatment system consists of only SCR, without EGR, DOC or DPF. Minimal of components are used and no downtime for regeneration or decreased service intervals. No EGR also results in less heat rejection, leading to excellent power density and improved fuel economy.

Compact & simple installation

SCR technology selected by Volvo Group does not increase the amount of cooling capacity needed. In combination with the compact engine design, installation is easy with minor impact on existing installation layout. Installation guidelines as well as drawings and CAD models are easy to access.

Durability & low noise

Volvo Group´s long experience with SCR systems in combination with base engine development reduces risk of downtime. Well-balanced to produce smooth and vibration free operation with low noise.

Low exhaust emission

Efficient injection as well as robust engine design in combination with SCR technology contributes to excellent combustion and low fuel consumption.

Easy service & maintenance

Easily accessible service and maintenance points contribute to the ease of service.

- **Proven and straight-forward design - built on Volvo Group technology**
- **Low cost of ownership and operation**
- **SCR only - no EGR, DOC, DPF or regeneration**
- **High efficient cooling system**
- **Excellent step load performance acc. to ISO 8528-5**
- **Compact, simple installation and easy to service**
- **Available as Genpac or Base engine configuration**

60 Hz/1800 rpm

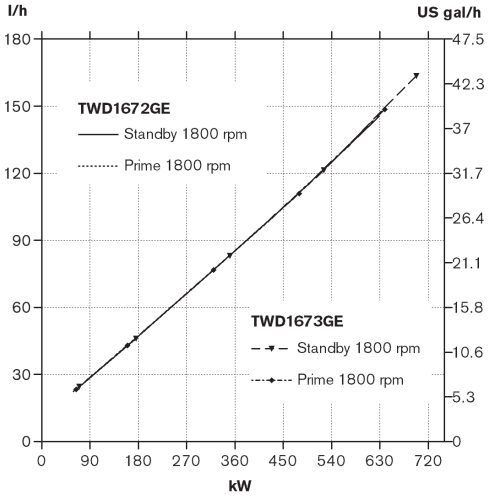
	Prime power			Standby power			Generator eff.
Engine	**kWm**	**kWe**	**kVa**	**kWm**	**kWe**	**kVa**	**(%)**
TWD1672GE	532	508	635	585	559	698	95,5
TWD1673GE	595	570	713	655	625	781	95,5

TWD1672-1673GE

Technical Data

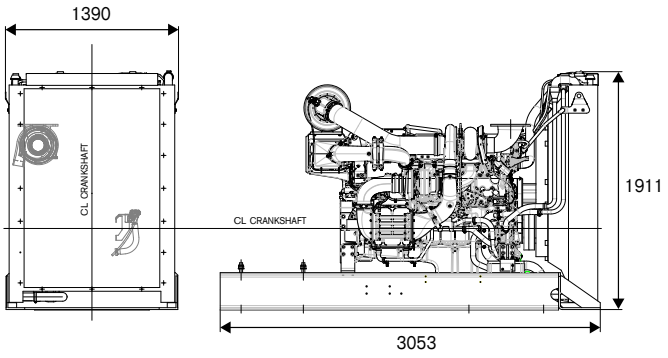
Engine designation	TWD1672-1673GE
Configuration and no. of cylinders	in-line 6
Displacement, l (in³)	16.12 (983.9)
Method of operation	4-stroke
Bore, mm (in.)	144 (5.67)
Stroke, mm (in.)	165 (6.50)
Compression ratio	16.8:1
Wet weight, engine only, kg (lb)	1810 (3390)
Wet weight, Genpac (engine, cooling system, air filtration system and frame kg (lb)	2767(6100)

Performance (with fan, kW (hp))	**1800 rpm**
TWD1672GE	
Prime Power	532 (724)
Standby Power	585 (796)
Fan power consumption	30 (41)
TWD1673GE	
Prime Power	595 (809)
Standby Power	655 (891)
Fan power consumption	30 (41)



Dimensions

Not for installation. Dimensions in mm.



Technical description

Engine and block
- Cast iron cylinder block with optimum distribution of forces without the block being unnessarily heavy.
- Wet, replaceable cylinder liners
- Tapered connecting rods for increased piston lifetime
- Crankshaft induction hardened bearing surfaces and fillets with seven bearings for moderate load on main and high-end bearings
- Case hardened and Nitrocarburized transmission gears for heavy duty operation
- Viscous type crankshaft vibration dampers to withstand single bearing alternator torsional vibrations
- Replaceable valve guides and valve seats
- Over head camshaft and 4 valves per cylinder

Lubrication system
- Full flow oil cooler
- Full flow disposable spin-on oil filter, for extra high filtration
- The lubricating oil level can be measured at start-up

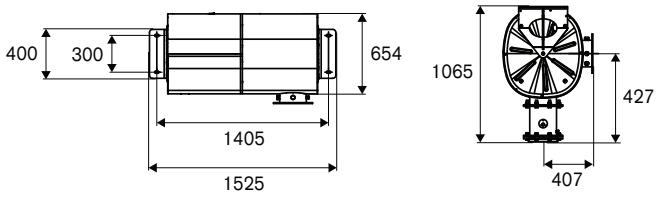
Fuel system
- Electronic high pressure unit injectors
- Fuel prefilter with water separator and water-in-fuel indicator / alarm
- Fine fuel filter with manual feed pump and fuel pressure switch

Cooling system
- Efficient cooling with accurate coolant control through a water distribution duct in the cylinder block.
- Belt driven coolant pumps with high degree of efficiency
- Water-cooled charge air coolers

Turbo charger
- Efficient and reliable dual stage turbo chargers
- Intermediate charge air coolers for both turbo chargers
- Waste gate system for the high pressure turbo charger

Electrical system
- Engine Management System 2.3 (EMS 2.3), an electronically controlled processing system which optimizes engine performance. It also includes advanced facilities for diagnostics and fault tracing
- The instruments and controls connect to the engine via the CAN SAE J1939 interface. The DCU is a control panel with display, engine control, monitoring, alarm, parameter setting and diagnostic functions. It also presents error codes in clear text. The DCU makes it possible to install and combine several sets of analogue and digital instruments.
- Sensors for oil pressure, oil temp, boost pressure, boost temp, coolant temp, fuel temp, water in fuel, fuel pressure and two speed sensors.

Exhaust aftertreatment system
- SCR only. No EGR, DOC, DPF or regeneration. Wide range of installation options available.
- AdBlue/DEF tank including AdBlue/DEF Quality Level Temperature Sensor



Rating guidelines

PRIME POWER rating corresponds to ISO Standard Power for continuous operation. It is applicable for supplying electrical power at variable load for an unlimited number of hours instead of commercially purchased power. A10 % overload capability for govering purpose is available for this rating.
STANDBY POWER rating corresponds to ISO Standard Fuel Stop Power. It is applicable for supplying standby electrical power at variable load in areas with well established electrical networks in the event of normal utility power failure. No overload capability is available for this rating.
1 kW = 1 hp x 1.36
1 hp = 1 kW x 0.7355

Power standards

The engine performance corresponds to ISO 3046, BS 5514 and DIN 6271. The technical data applies to an engine without cooling fan and operating on a fuel with calorific value of 42.7 MJ /kg (18360 BTU/lb) and a density of 0.84 kg/liter (7.01 lb/US gal), also where this involves a deviation from the standards. Power output guaranteed within 0 to +2% att rated ambient conditions at delivery. Ratings are based on ISO 8528. Engine speed governing in accordance with ISO 3046/IV, class A1 and ISO 8528-5 class G3

Additional information

For additional information, please contact your Volvo Penta representative or visit www.volvopenta.com

Not all models, standard equipment and accessories are available in all countries. All specifications are subject to change without notice. The engine illustrated may not be entirely identical to production standard engines.

VOLVO PENTA

AB Volvo Penta
SE-405 08 Göteborg, Sweden
www.volvopenta.com

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Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with ⚠ are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalities as described in the Clean Air Act.

General

In-line four stroke diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel. Turbocharged

Number of cylinders			6
Displacement, total		litre in^3	16,12 983,9
Firing order			1-5-3-6-2-4
Bore		mm in	144 5,67
Stroke		mm in	165 6,50
Compression ratio			16,8:1
Wet weight (Not including after treatment system)	Engine only	kg lb	1810 3990
	Engine incl. cooling system and air filtration system	kg lb	2217 4888
	Frame	kg lb	550 1213
	Compensator and Mixer pipe	kg lb	25 55
	EATS Muffler	kg lb	188 414

Performance			rpm	1500	1800
Prime Power		without fan	kW	NA	625
			hp	NA	850
		with fan	kW	NA	595
			hp	NA	809
Standby Power		without fan	kW	NA	685
			hp	NA	932
		with fan	kW	NA	655
			hp	NA	891
Torque at:	Prime Power		Nm	NA	3316
			lbft	NA	2445
	Standby Power		Nm	NA	3634
			lbft	NA	2680
Mean piston speed			m/s	NA	9,9
			ft/sec	NA	32,6
Effective mean pressure at:	Prime Power		MPa	NA	2,6
			psi	NA	375
Effective mean pressure at:	Standby Power		MPa	NA	2,8
			psi	NA	411
Max combustion pressure at:	Prime Power		MPa	NA	22
			psi	NA	3191
Max combustion pressure at:	Standby Power		MPa	NA	22,5
			psi	NA	3263
Total mass moment of inertia, J (mR^2) with flywheel			kgm^2	2,50	
			$lbft^2$	59,3	
Total mass moment of inertia, J (mR^2) without flywheel			kgm^2	1,92	
			$lbft^2$	45,6	
Friction Power			kW	NA	51
			hp	NA	69,4

Derating due to altitude - see Technical Diagrams

Engine noise emission
Test Standards: ISO 3744-1981 (E) sound power
Tolerance ± 0.75 dB(A)

		rpm	1500	1800
Measured sound power Lw	No load	dB(A)	NA	118,1
	Prime Power	dB(A)	NA	119,1
	Standby Power	dB(A)	NA	118,9
Calculated sound pressure Lp at 1 m	No load	dB(A)	NA	101,1
	Prime Power	dB(A)	NA	102,1
	Standby Power	dB(A)	NA	101,9

Test conditions for load acceptance data

Warm engine.	**Generator**			**Model**		**Type of AVR**	
	Stamford			HCM534F1		MX341	
AVR Settings	UFRO (Hz):		57	DIP (%)*:	50	DWELL (%)*:	N/A
	Stability (%)*:	According to Stamford instructions		Voltage (V):	400	Load factor:	1.0

Applies to Stamford nomenclature,
(%)* : % of max potentiometer setting range
Load acceptance performance can vary due to actual alternator inertia, voltage regulator, type of load and local ambient conditions.

Abbreviation:	**Full name:**	**Descriptions**
AVR	Automatic Voltage Regulator	Generator performance and safty control unit
UFRO	Under Frequency Roll Off	Overheating protection at under frequency
DIP		Controls the slope of voltage drop when the UFRO is active
DWELL		Controls the slope of voltage recovery when the UFRO is active.

Single step load performance at 1800 rpm - PRIME (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	2,6	1,5	0,5	0,0	20-100	8,8	2,9	17,6	1,6
0-40	4,8	2,1	5,3	1,2	40-100	5,9	2,5	9,8	1,5
0-52	7 (G3)	2,3	10,6	1,2	58-100	4,5	2,2	4,0	1,1
0-60	7,4	2,3	11,6	1,2	60-100	4,5	2,1	3,5	1,1
0-68	10 (G2)	2,7	17,1	1,2	71-100	3,5	1,8	2,0	0,8
0-80	12,3	3,1	22,4	1,4	80-100	2,6	1,4	1,5	0,4
0-100	17,4	3,4	31,7	2,1					
100-0	5,6	1,9	8,3	1,7					

Single step load performance at 1800 rpm - STAND BY (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	2,9	1,5	0,8	0,6	20-100	10,8	3,2	21,6	1,7
0-40	5,1	2,1	5,8	1,1	40-100	6,9	2,8	12,3	1,6
0-54	7 (G3)	2,3	10,8	1,2	54-100	5,3	2,4	6,0	1,4
0-60	8,4	2,7	14,6	1,2	60-100	4,7	2,2	4,0	1,4
0-67	10 (G2)	2,9	16,8	1,2	67-100	4,3	2,1	3,3	1,2
0-80	13,3	3,2	24,1	1,7	80-100	3,1	1,6	2,3	0,8
0-100	19,8	3,8	35,4	1,8					
100-0	4,3	1,0	9,8	2,4					

Cold start performance			rpm	1500	1800
Time from start to stay within 0.5% of no load speed at ambient temperature:	°C	20	s	NA	4,3
		5	s	NA	5,3
		-15 *	s	NA	5,3
		-30 **	s	NA	5,7
		Min start temp*	°C	-31,0	

* With manifold heater 4 kW engaged, lubrication oil 15W/40 and block heater.
** With manifold heater 4 kW engaged, lubrication oil 5W/30 and block heater, Fuel MK-1.

Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
Volvo part No: 22454340 P01	Calix	1.5 kW	10h ambient temp-30 C	-2°C 28°F

Lubrication system			rpm	1500	1800
Lubricating oil consumption	Prime Power		litre/h	NA	0,10
			US gal/h		0,026
	Standby Power		litre/h	NA	0,11
			US gal/h		0,029
Oil system capacity including filters			litre	48	
			US gal	12,7	
Oil sump capacity:		max	litre	42	
			US gal	11,1	
		min	litre	32	
			US gal	8,5	
Oil change intervals/specifications:	VDS-3*		h	500	
Engine angularity limits:		front up	°	30	
		front down	°	30	
		side tilt	°	30	
Oil pressure at rated speed			kPa	NA	399
			psi	NA	58
Lubrication oil temperature in oil sump:		max	°C	130	
			°F	266	
Oil filter micron size			µ	40	

* See also general section in the sales guide

Fuel system			rpm	1500	1800
Prime Power	25%	g/kWh		NA	227
Specific **fuel** consumption at:		lb/hph		NA	0,368
	50%	g/kWh		NA	202
		lb/hph		NA	0,327
	75%	g/kWh		NA	195
		lb/hph		NA	0,316
	100%	g/kWh		NA	195
		lb/hph		NA	0,316
% adBlue consumption at:	25%	%		NA	6,4
(Compare to Fuel consumption by Volyme)	50%	%		NA	6,7
	75%	%		NA	7,2
	100%	%		NA	6,4

Standby Power	25%	g/kWh		NA	223
Specific **fuel** consumption at:		lb/hph		NA	0,361
	50%	g/kWh		NA	201
		lb/hph		NA	0,326
	75%	g/kWh		NA	195
		lb/hph		NA	0,316
	100%	g/kWh		NA	197
		lb/hph		NA	0,319
% adBlue consumption at:	25%	%		NA	6,6
(Compare to Fuel consumption by Volyme)	50%	%		NA	6,7
	75%	%		NA	7,2
	100%	%		NA	6,1

Fuel system		rpm	1500	1800
See front page for important information ⚠ Fuel to conform to	ASTM D975 (2D)			
System supply flow at:		litre/h	NA	210,0
		US gal/h	NA	55,5
Fuel supply line max restriction		kPa	NA	30,0
(Measured at fuel inlet connection)		psi	NA	4,4
Fuel supply line max pressure, engine stopped		kPa	NA	0,0
		psi	NA	0,0
System return flow		litre/h	NA	25,0
		US gal/h	NA	6,6
Fuel return line max restriction		kPa	NA	20,0
(Measured at fuel return connection)		psi	NA	2,9
Maximum allowable inlet fuel temp		°C	NA	60
(Measured at fuel inlet connection)		°F	NA	140
Prefilter / Water separator micron size		µ	10	
Fuel filter micron size		µ	5	
Governor type/make, standard		Volvo/EMS 2.3		
Injection pump type/make		Unit injector hybrid		

Intake and exhaust system		rpm	1500	1800
Air consumption at: (+25°C and 100kPa)	Prime Power	m^3/min	NA	48,1
		cfm	NA	1699
	Standby Power	m^3/min	NA	51,1
		cfm	NA	1805
See front page for important information ⚠ Max allowed air intake restriction including piping		kPa	NA	5
		psi	NA	0,7
Air filter restriction clean Volvo Penta filter		kPa	NA	1,4
		psi	NA	0,2
Heat rejection to exhaust at:	Prime Power	kW	NA	458
		BTU/min	NA	26072
	Standby Power	kW	NA	521
		BTU/min	NA	29623
Exhaust gas temperature after turbine at:	Prime Power	°C	NA	455
		°F	NA	851
	Standby Power	°C	NA	484
		°F	NA	903
See front page for important information ⚠ Max allowable back pressure in exhaust line (after turbine) Pipe dimension Ø: mm	Prime Power	kPa	NA	19
		psi	NA	2,7
	Standby Power	kPa	NA	20
		psi	NA	2,9
See front page for important information Max allowable temperature drop between turbine and SCR muffler inlet. ⚠	Prime Power	Δ°C	NA	10
		Δ°F	NA	18
	Standby Power	Δ°C	NA	10
		Δ°F	NA	18
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)	Prime Power	kPa	NA	9
		psi	NA	1,3
	Standby Power	kPa	NA	10
		psi	NA	1,5
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	Prime Power	m^3/min	NA	126,6
		cfm	NA	4471
	Standby Power	m^3/min	NA	137,8
		cfm	NA	4866

Cooling system			rpm	1500	1800
Heat rejection radiation from engine at:		Prime Power	kW	NA	26
			BTU/min	NA	1479
		Standby Power	kW	NA	29
			BTU/min	NA	1649
Coolant		Volvo Penta coolant "ready mix or Volvo Penta coolant mixed with fresh water 40/60			
Radiator cooling system type			Closed circuit		
Standard radiator core area			m²	NA	1,68
			foot²	NA	18,08
Fan diameter			mm	NA	965
			in	NA	37,99
Fan power consumption			kW	NA	30
			hp	NA	41
Fan drive ratio					1.04:1
Coolant capacity,	Engine only		litre	NA	33
			US gal	NA	8,72
	CACs (Charge Air Coolers)		litre	NA	10
			US gal	NA	2,64
	Coolant radiators incl piping, Engine circuit		litre	NA	48
			US gal	NA	12,68
	Coolant radiators incl piping, CAC- circuit		litre	NA	48
			US gal	NA	12,68
	Expansion tank, Engine circuit		litre	NA	20
			US gal	NA	5,28
	Expansion tank, CAC circuit		litre	NA	7
			US gal	NA	1,85
Coolant pump			drive/ratio	Belt / 1,85:1	
Coolant pump , CAC circuit			drive/ratio	Belt / 2,29:1	
Thermostat, Engine circuit	Start to open		°C	NA	82
			°F	NA	180
	Fully open		°C	NA	92
			°F	NA	198
Thermostat, CAC circuit	Start to open		°C	NA	40
			°F	NA	104
	Fully open		°C	NA	52
			°F	NA	126
Maximum static pressure head (expansion tank height + pressure cap setting)			kPa	NA	100
			psi	NA	14,5
Minimum static pressure head (expansion tank height + pressure cap setting)			kPa	NA	70
			psi	NA	10,2
Standard pressure cap setting			kPa	NA	75
			psi	NA	10,9
Maximum top tank temperature			°C	NA	107
			°F	NA	225
Charge air pressure (after charge air coolers)			kPa	NA	360
			psi	NA	52,2
See front page for important information Max allowed Charge air outlet temp. At air inlet temp. 25°C ⚠	Prime Power		°C	NA	50
			°F	NA	122
	Standby Power		°C	NA	50
			°F	NA	122

OEM cooling system design:

- move of standard radiatorts		**rpm**	**1500**	**1800**
Maximum additional coolant, Engine circuit with standard expansion tank		litre	NA	15
		US gal	NA	3,96
Maximum additional coolant, CAC circuit with standard expansion tank		litre	NA	5
		US gal	NA	1,32
Maximum distans in vertikal direction with standard pressure cap (75 kPa)		m	NA	2,5
		ft	NA	8,20
Maximum additional pressure drop due to move		KPa	NA	10
		psi	NA	1,5
- replacement of standard radiators				
Heat rejection to coolant **engine radiator** at:	Prime Power	kW	NA	223
		BTU/min	NA	12682
	Standby Power	kW	NA	245
		BTU/min	NA	13933
Heat rejection to coolant **CAC radiator** at:	Prime Power	kW	NA	208
		BTU/min	NA	11829
	Standby Power	kW	NA	216
		BTU/min	NA	12284
Minimum coolant flow **engine radiator** (at fully open thermostat)		litre/s	NA	6
		US gal/s	NA	1,59
Minimum coolant flow **CAC radiator** (at fully open thermostat)		litre/s	NA	2,5
		US gal/s	NA	0,66
Maximum coolant pressure drop over **engine radiator** incl. Piping (at coolant flow above)		kPa	NA	70
		psi	NA	10,2
Coolant pressure drop over complete engine circuit cooling system (at coolant flow above)		kPa	NA	160
		psi	NA	23,2
Coolant pressure drop over complete CAC circuit cooling system (at coolant flow above)		kPa	NA	135
		psi	NA	19,6
Nominal coolant pressure before engine circuit coolant pump		kPa	NA	30
		psi	NA	4,4
Nominal coolant pressure before CAC circuit coolant pump		kPa	NA	30
		psi	NA	4,4

Cooling performance

Standard fan: Fan ratio: 1 : 1.04 Fan type: FIX

Cooling air flow and external restriction at different radiator air temperatures based on 107°C TTT and 40% antifreeze.
Valid at 1 atm. (radiator and cooling fan, see optional equipment)

Engine speed rpm	Air on temp °C	PRIME POWER		STANDBY POWER	
		Air flow m^3/s	External restriction Pa	Air flow m^3/s	External restriction Pa
1800	63	15,2	0		
	62	14,5	100	15,2	0
	61	14,1	200		
	60	13,6	300		
	59			14,5	100
	58			13,9	200
	57			13,6	300

Note! External restrictions are calculated for values >0 Pa

Engine management system

Functionality	Alternatives	Default setting
Governor mode	Isochronous	Isochronous
Governor droop	N/A	N/A
Governor response	Adjustable PID-constants (VODIA)	
Dual speed	Single speed 1800rpm, 60Hz	1800,0
Idle speed	600-1200rpm	900,0
Fine speed adjustment	+- 90 rpm	0,0
Preheating function	On / Off	Off

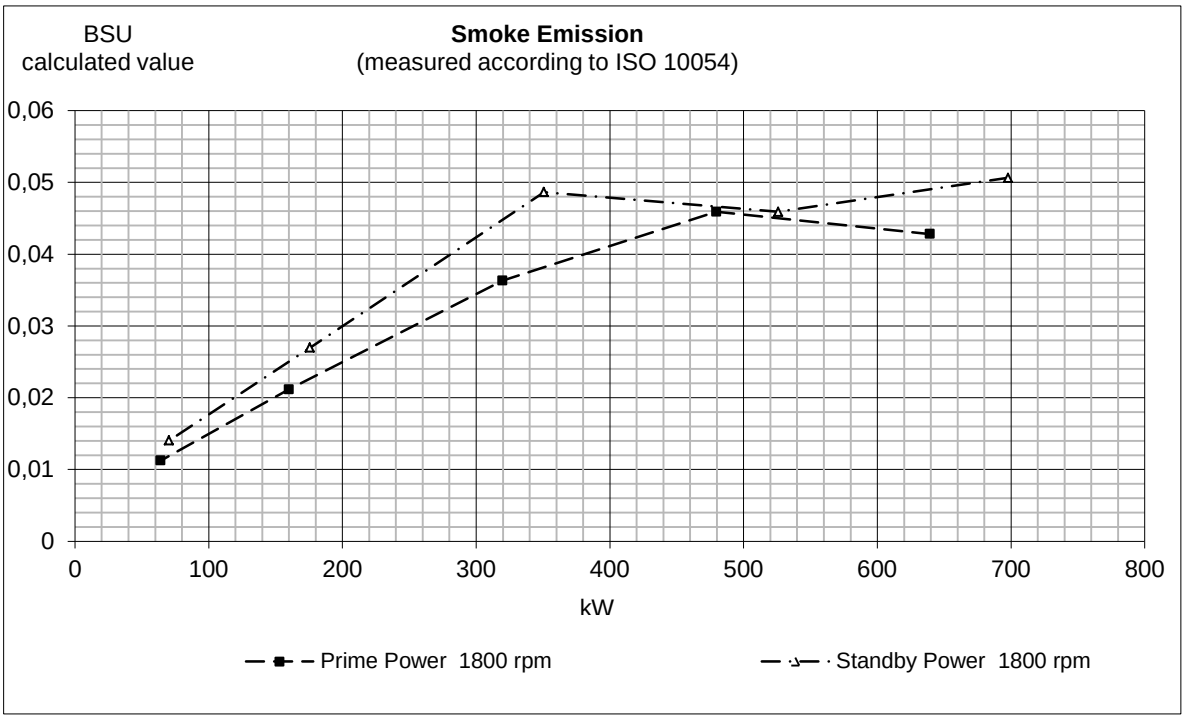
Engine sensor and switch settings

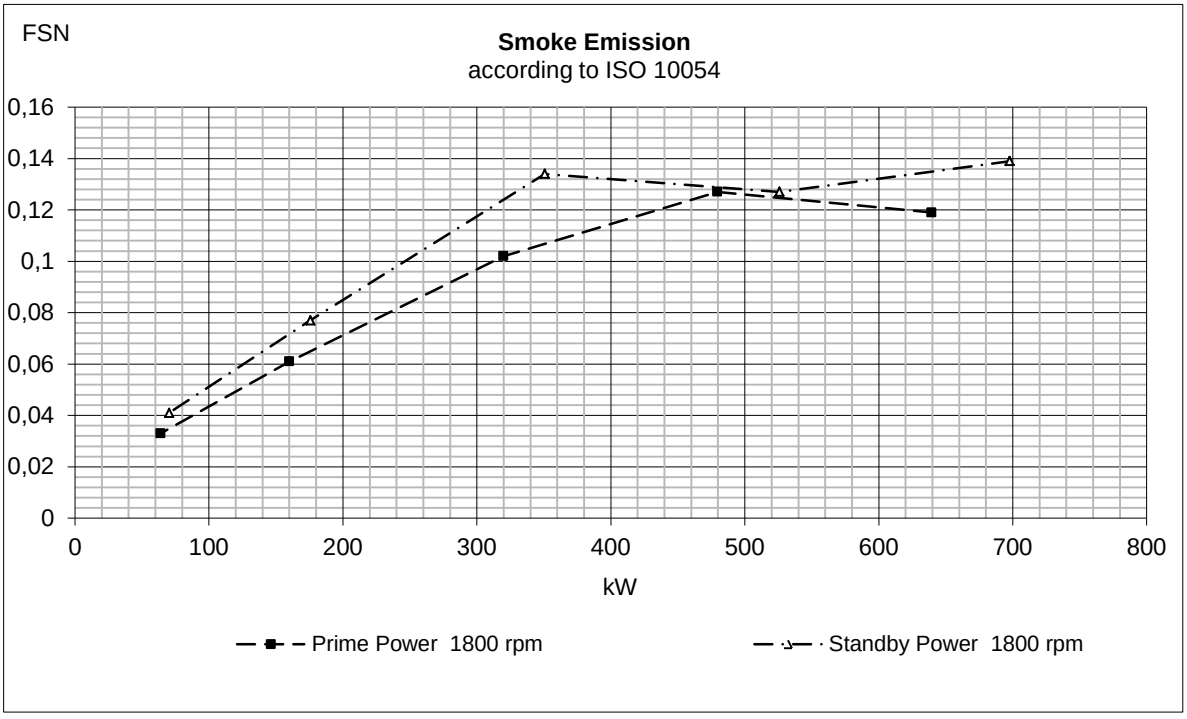
			Alarm level		Engine protection	
Parameter		Unit	Setting range	Default setting	Level	Action. Default/Alternative
Oil temp		°C	120 - 130	125	Setting +2.5	Shutdown after 10s
Oil pressure	Low idle 900rpm	kPa	NA	170	145	Shutdown
	1800 rpm	kPa	NA	300	275	Shutdown
Oil level			NA	Min level		
DEF dosing injector failure			NA	On	Low level	Shutdown after 10s
Coolant temp		°C	95 - 101	103	Setting +4	Shutdown after 10s
Coolant level			See cooling system	On	Low level	Shutdown after 10s
Fuel feed pressure	Low idle	kPa	NA	Min level		
	>1400 rpm	kPa	NA	Min level		
Water in fuel			NA	Max level		
Crank case pressure		kPa	NA	Rapid increase	Rapid increase	Shutdown
Air filter pressure drop		kPa	NA	5		
Altitude, above sea		m				Automatic derating, see section Smoke, Fuel & Derating
Charge air temp		°C	NA	80	82,5	Shutdown after 10s
Charge air pressure		kPa	NA	25 above demand	35 above demand	Shutdown after 1s
Engine speed		rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	Shutdown
Exhaust Temperature (before SCR volume)		°C	NA	530	550,0	Shutdown after 10s
Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy						

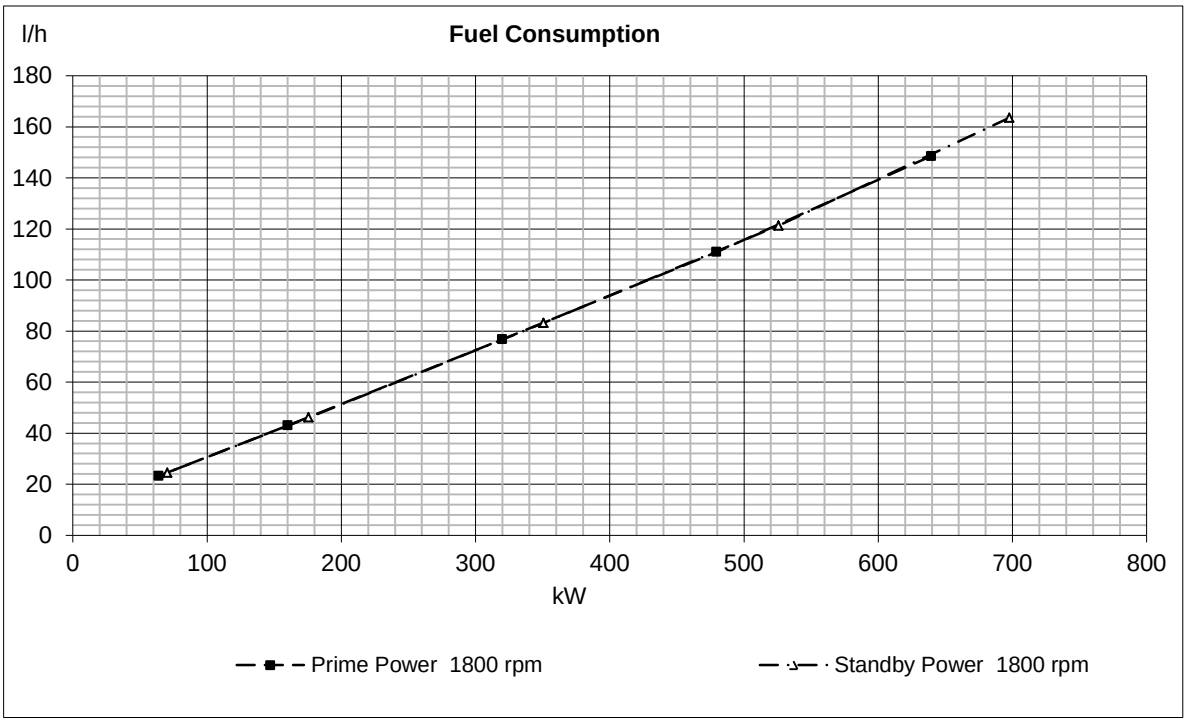
Electrical system

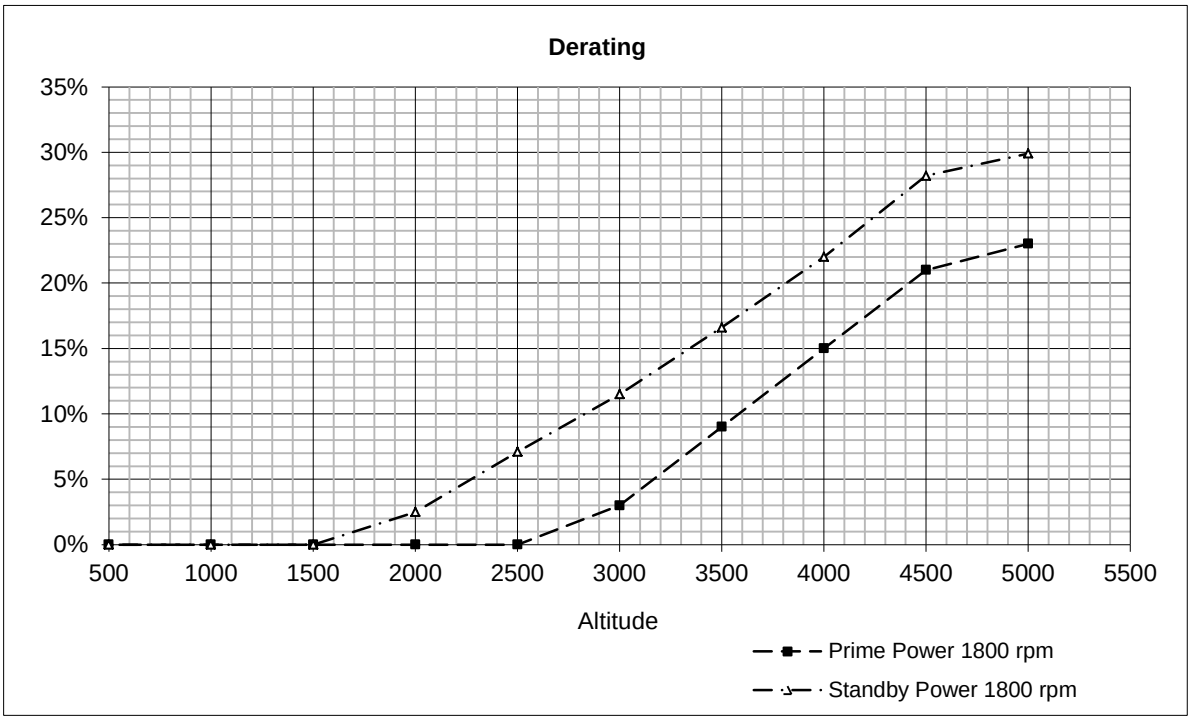
Voltage and type		24V / insulated from earth	
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		3,94 : 1
Starter motor		make	Mitsubishi Electric
		type	24V7.0KW12/3.175F
		kW	7,0
Number of teeth on:	flywheel		153
	starter motor		12
Max wiring resistance main circuit		mΩ	
Cranking current at +20°C		A	300
Crank engine speed at 20°C		rpm	155
Starter motor battery capacity:	max	Ah/A	2x225
	min at +5°C	Ah/A	
Inlet manifold heater (at 20 V)		kW	4,0
Power relay for the manifold heater		A	1

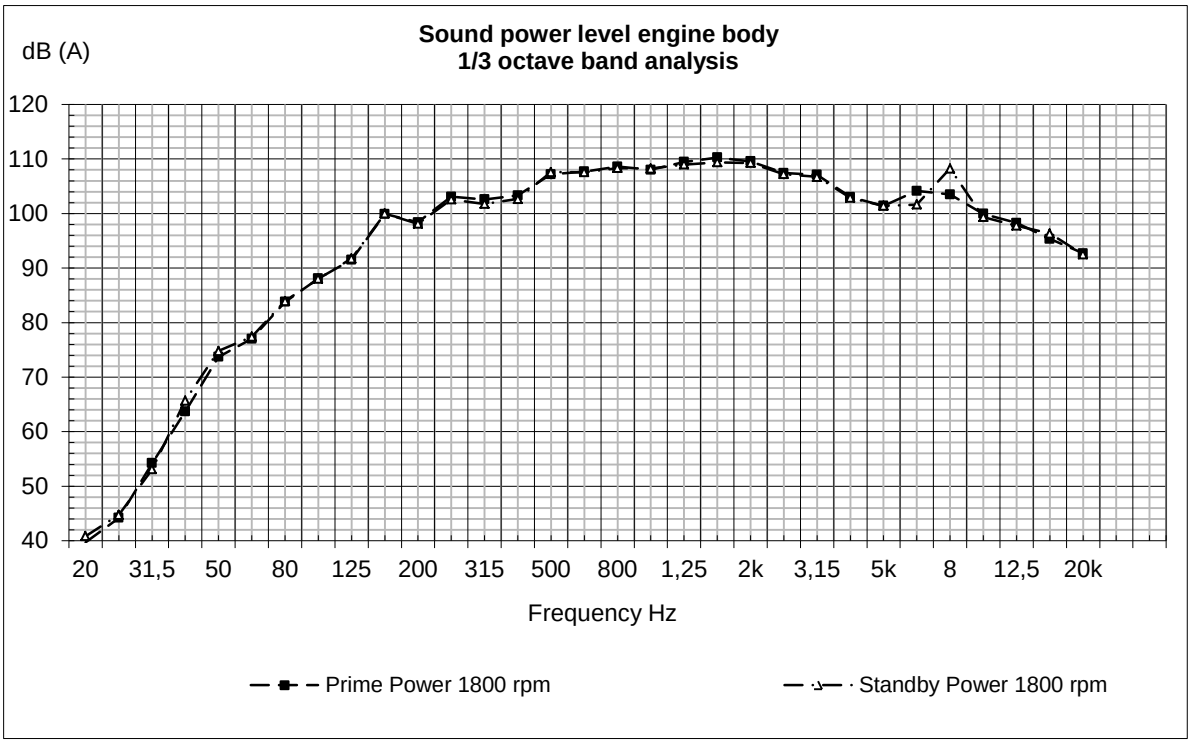
Power take off		**rpm**	**1500**	**1800**
Front end in line with crank shaft max:		Nm	NA	NA
		lbft	NA	NA
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	NA	NA
		hp	NA	NA
	max down	kW	NA	NA
		hp	NA	NA
	max right	kW	NA	NA
		hp	NA	NA
Timing gear at compressor PTO max:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side		0,91:1/clockwise		
Timing gear at servo pump PTO max:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side		1,58:1/clockwise		
Timing gear at hydraulic pump PTO max:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side				
Max allowed bending moment in flywheel housing		Nm	15000	
		lbft	11063	
Max. rear main bearing load		N	NA	NA
		lbf	NA	NA

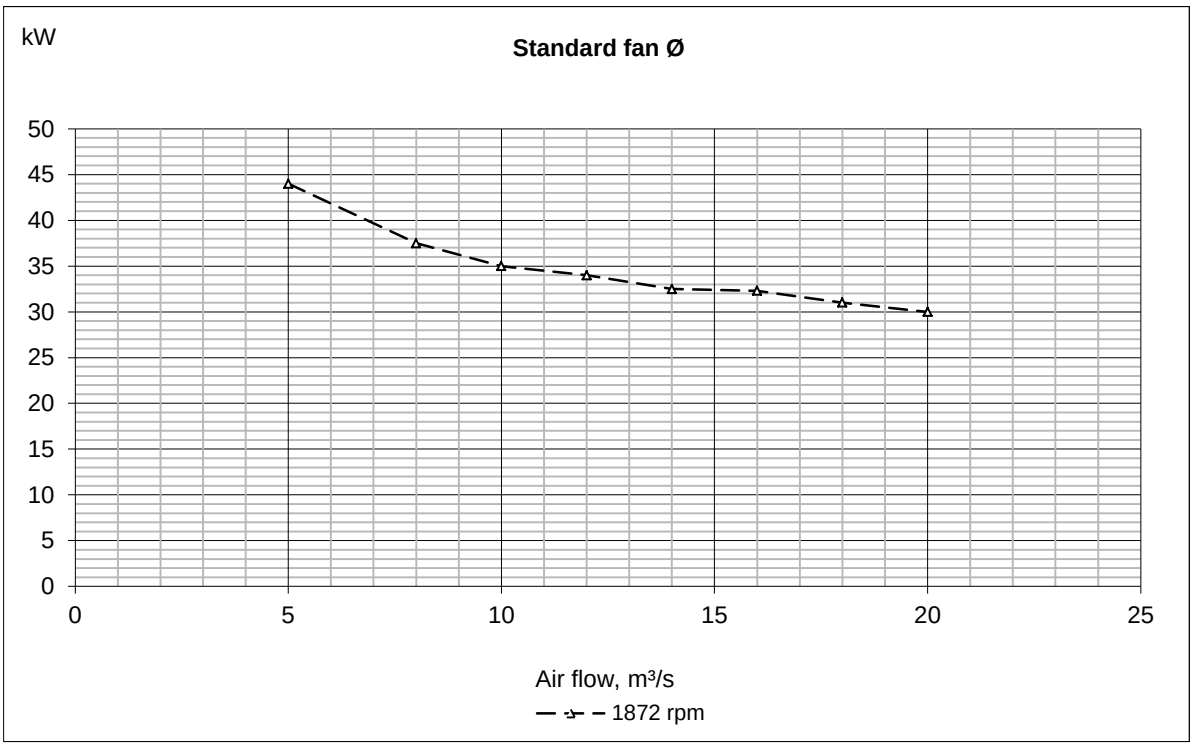

BSU
calculated value
Smoke Emission
(measured according to ISO 10054)
0,06
0,05
0,04
0,03
0,02
0,01
0
0
100
200
300
400
500
600
700
800
kW
Prime Power 1800 rpm
Standby Power 1800 rpm

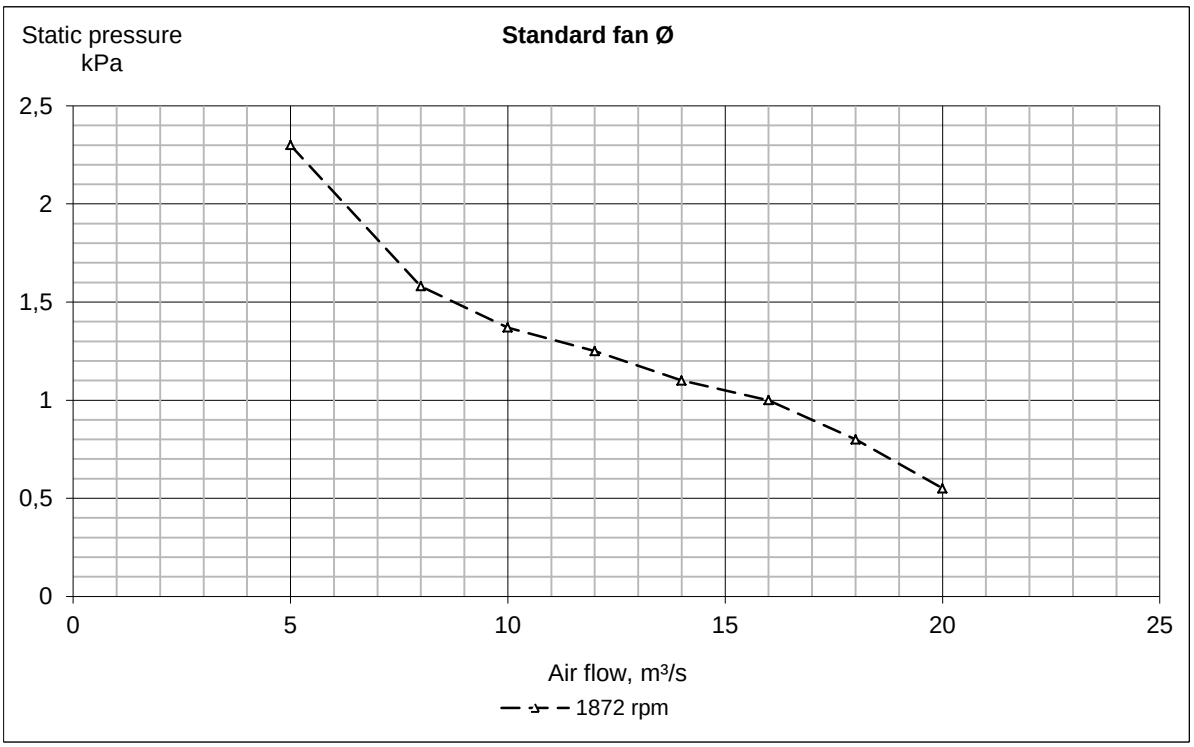

FSN
Smoke Emission
according to ISO 10054
0,16
0,14
0,12
0,1
0,08
0,06
0,04
0,02
0
0
100
200
300
400
500
600
700
800
kW
Prime Power 1800 rpm
Standby Power 1800 rpm


Fuel Consumption
l/h
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
kW
Prime Power 1800 rpm
Standby Power 1800 rpm


Derating
35%
30%
25%
20%
15%
10%
5%
0%
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
Altitude
Prime Power 1800 rpm
Standby Power 1800 rpm


Sound power level engine body
1/3 octave band analysis
dB (A)
120
110
100
90
80
70
60
50
40
20
31,5
50
80
125
200
315
500
800
1,25
2k
3,15
5k
8
12,5
20k
Frequency Hz
Prime Power 1800 rpm
Standby Power 1800 rpm

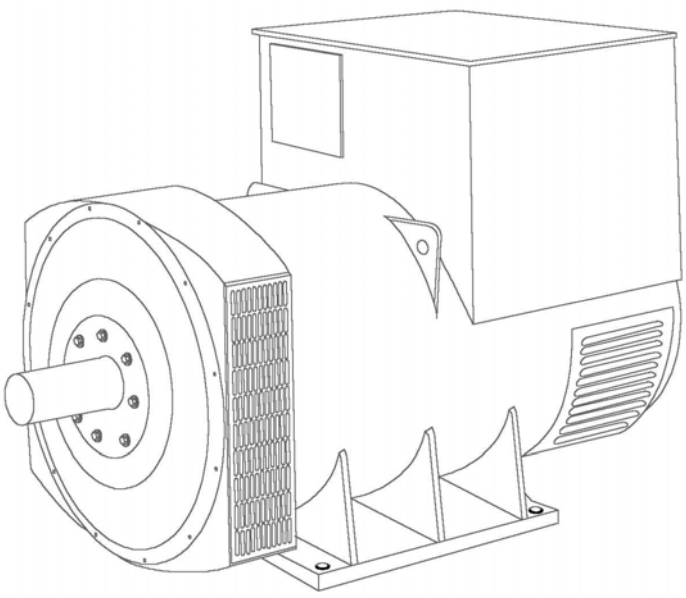

kW
Standard fan Ø
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
Air flow, m³/s
1872 rpm


Static pressure
kPa
Standard fan Ø
2,5
2
1,5
1
0,5
0
0
5
10
15
20
25
Air flow, m³/s
1872 rpm

STAMFORD®

HCI634G - Winding 311 and 312

Technical Data Sheet



SPECIFICATIONS & OPTIONS
WINDING 311 and 312

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

MX321 AVR - STANDARD

This sophisticated Automatic Voltage Regulator (AVR) is incorporated into the Stamford Permanent Magnet Generator (PMG) system and is fitted as standard to generators of this type.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators feature a main stator with either 6 ends (Winding 312) or 12 ends (Winding 311) brought out to the terminals, which are mounted on the frame at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

APPROVED DOCUMENT

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.
10% when IP44 Filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5°C by which the operational ambient temperature exceeds 40°C.
Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

WINDING 311 and 312

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.	
A.V.R.	MX321	
VOLTAGE REGULATION	± 0.5 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)	

INSULATION SYSTEM	CLASS H							
PROTECTION	IP23							
RATED POWER FACTOR	0.8							
STATOR WINDING	DOUBLE LAYER LAP							
WINDING PITCH	TWO THIRDS							
WINDING LEADS	6 (Wdg 312) or 12 (Wdg 311)							
STATOR WDG. RESISTANCE	0.003 Ohms PER PHASE AT 22°C STAR CONNECTED							
ROTOR WDG. RESISTANCE	1.75 Ohms at 22°C							
EXCITER STATOR RESISTANCE	17 Ohms at 22°C							
EXCITER ROTOR RESISTANCE	0.079 Ohms PER PHASE AT 22°C							
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others							
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
MAXIMUM OVERSPEED	2250 Rev/Min							
BEARING DRIVE END	BALL. 6224 (ISO)							
BEARING NON-DRIVE END	BALL. 6317 (ISO)							
	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	1965 kg				1989 kg			
WEIGHT WOUND STATOR	934 kg				934 kg			
WEIGHT WOUND ROTOR	814 kg				766 kg			
WR² INERTIA	18.3482 kgm^2				17.8009 kgm^2			
SHIPPING WEIGHTS in a crate	2023kg				2029kg			
PACKING CRATE SIZE	183 x 92 x 140(cm)				183 x 92 x 140(cm)			
	50 Hz				60 Hz			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	1.614 m³/sec 3420 cfm				1.961 m³/sec 4156 cfm			
VOLTAGE STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR (*)	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE DELTA	220	230	240	254	240	254	266	277
kVA BASE RATING FOR REACTANCE VALUES	800	800	800	800	875	925	963	1000
Xd DIR. AXIS SYNCHRONOUS	3.14	2.83	2.63	2.34	3.53	3.34	3.18	3.03
X'd DIR. AXIS TRANSIENT	0.25	0.23	0.21	0.19	0.28	0.26	0.25	0.24
X"d DIR. AXIS SUBTRANSIENT	0.18	0.16	0.15	0.13	0.21	0.20	0.19	0.18
Xq QUAD. AXIS REACTANCE	1.88	1.70	1.58	1.40	2.10	1.98	1.89	1.80
X"q QUAD. AXIS SUBTRANSIENT	0.21	0.19	0.18	0.16	0.24	0.23	0.22	0.21
X_L LEAKAGE REACTANCE	0.10	0.09	0.08	0.07	0.12	0.11	0.10	0.10
X_2 NEGATIVE SEQUENCE	0.22	0.20	0.19	0.17	0.24	0.23	0.22	0.21
X_0 ZERO SEQUENCE	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED							
T'd TRANSIENT TIME CONST.	0.185							
T"d SUB-TRANSTIME CONST.	0.025							
T'do O.C. FIELD TIME CONST.	2.35							
Ta ARMATURE TIME CONST.	0.04							
SHORT CIRCUIT RATIO	1/Xd							

(*) Parallel Star connection only available with Wdg 311

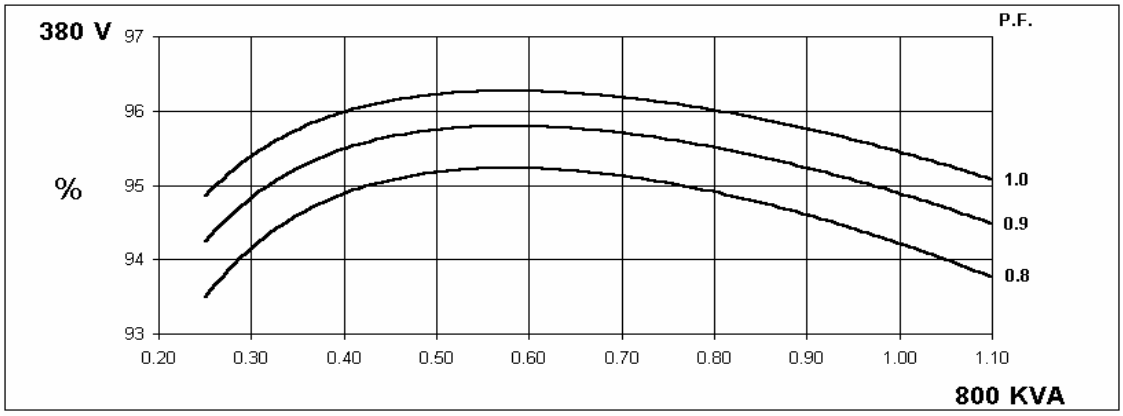
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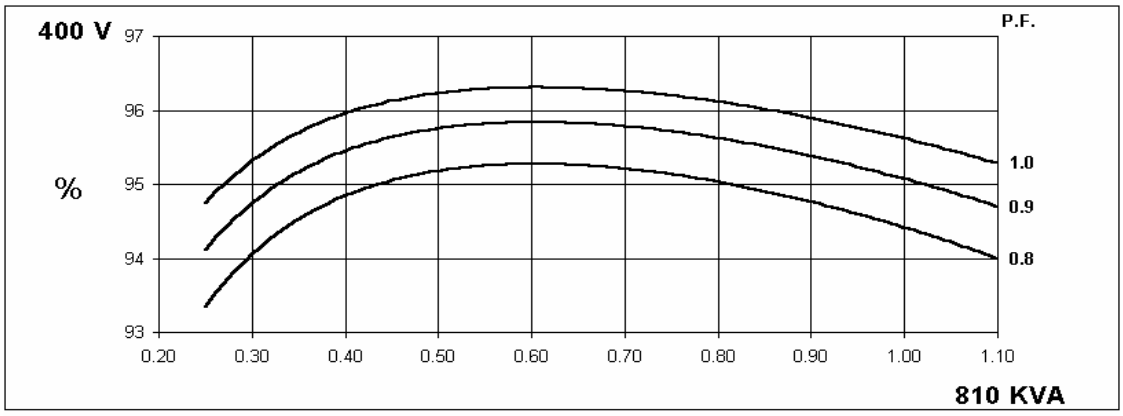
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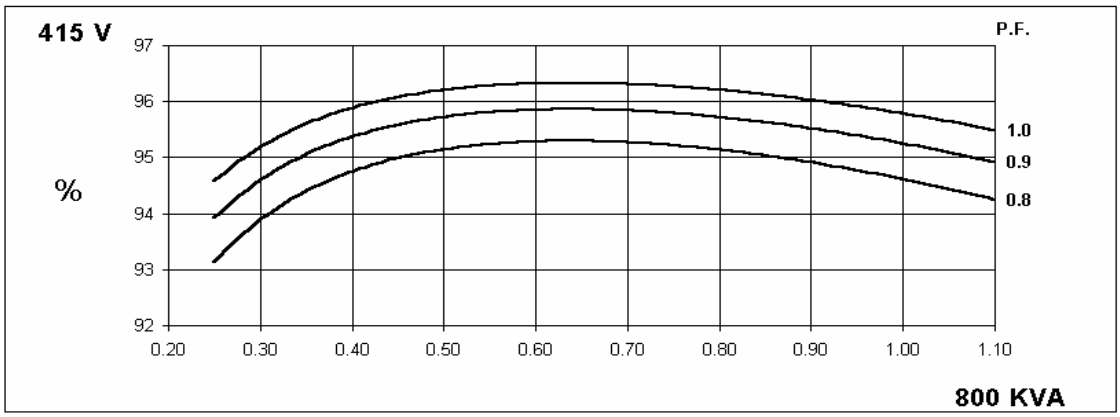
HCI634G

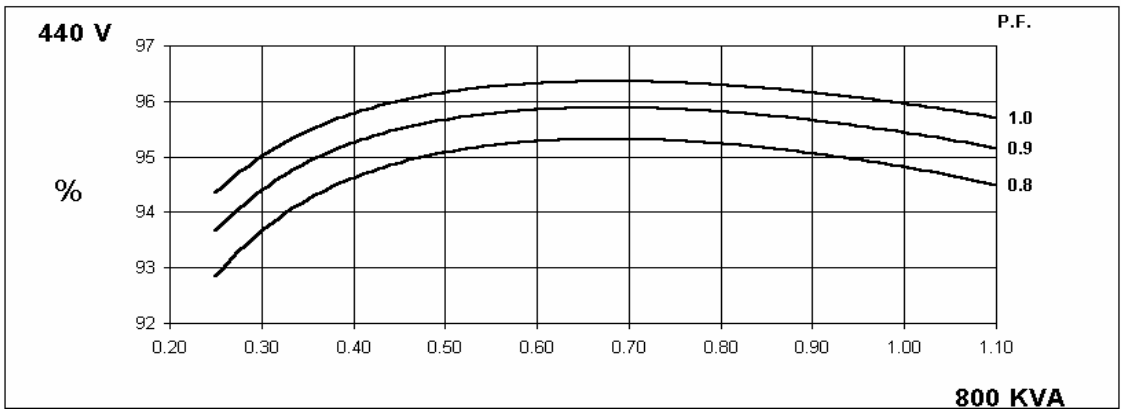
WINDING 311 and 312

THREE PHASE EFFICIENCY CURVES







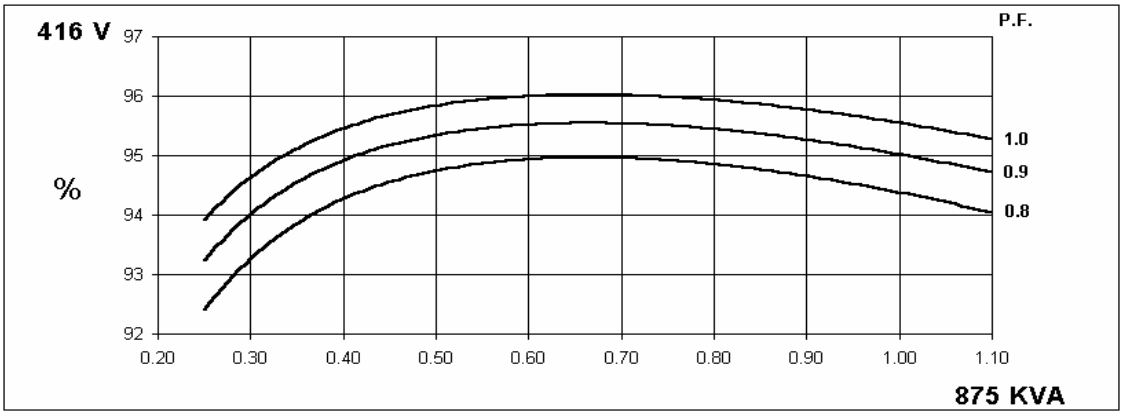


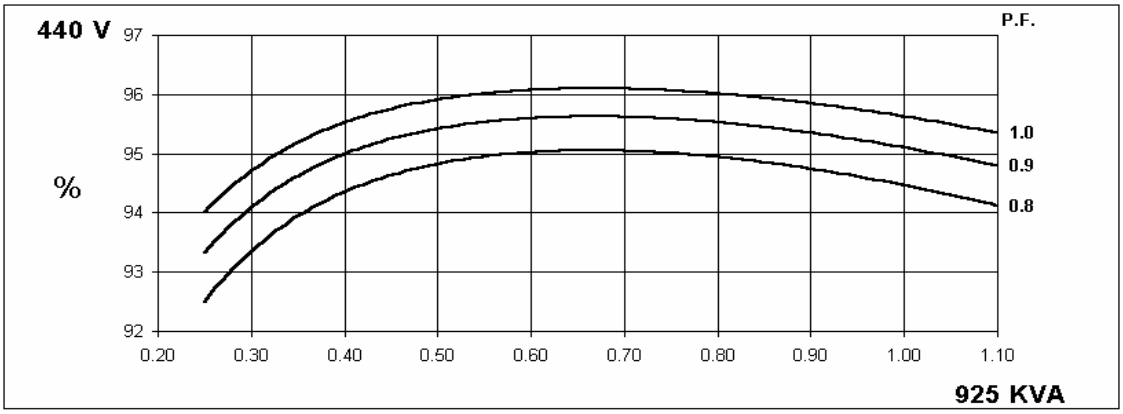
60 Hz

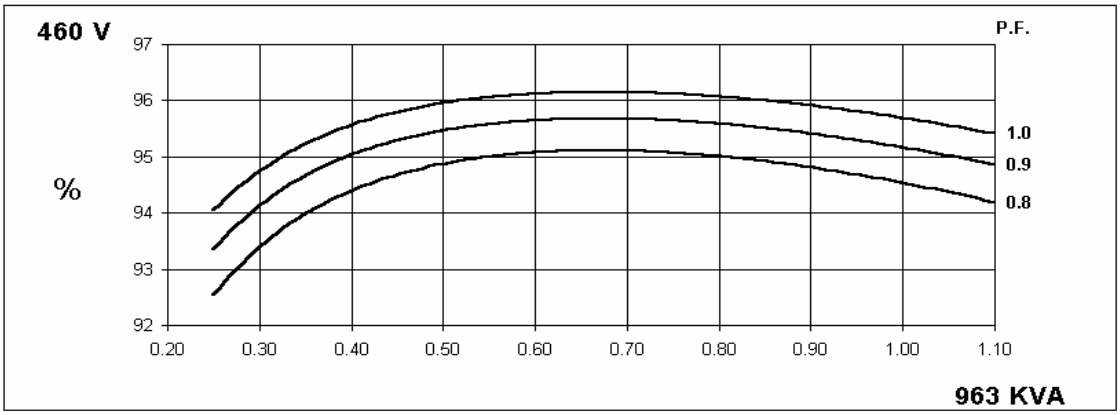
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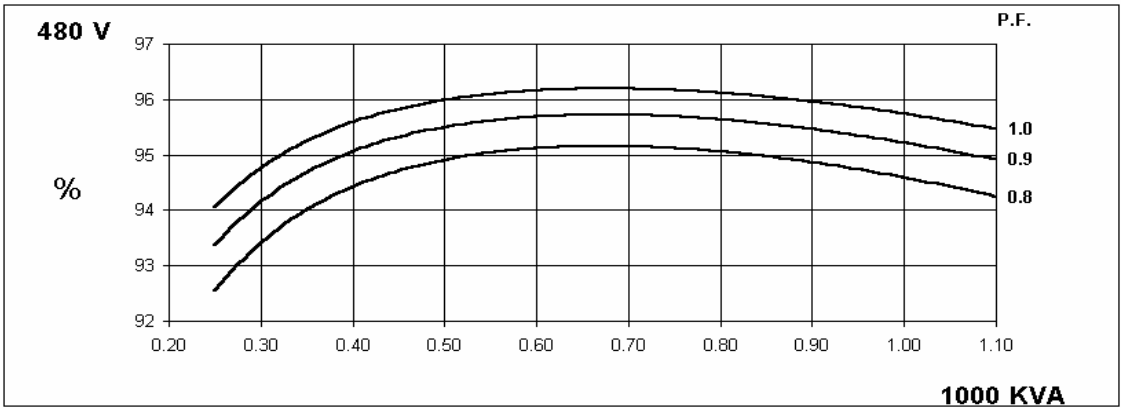
WINDING 311 and 312

THREE PHASE EFFICIENCY CURVES

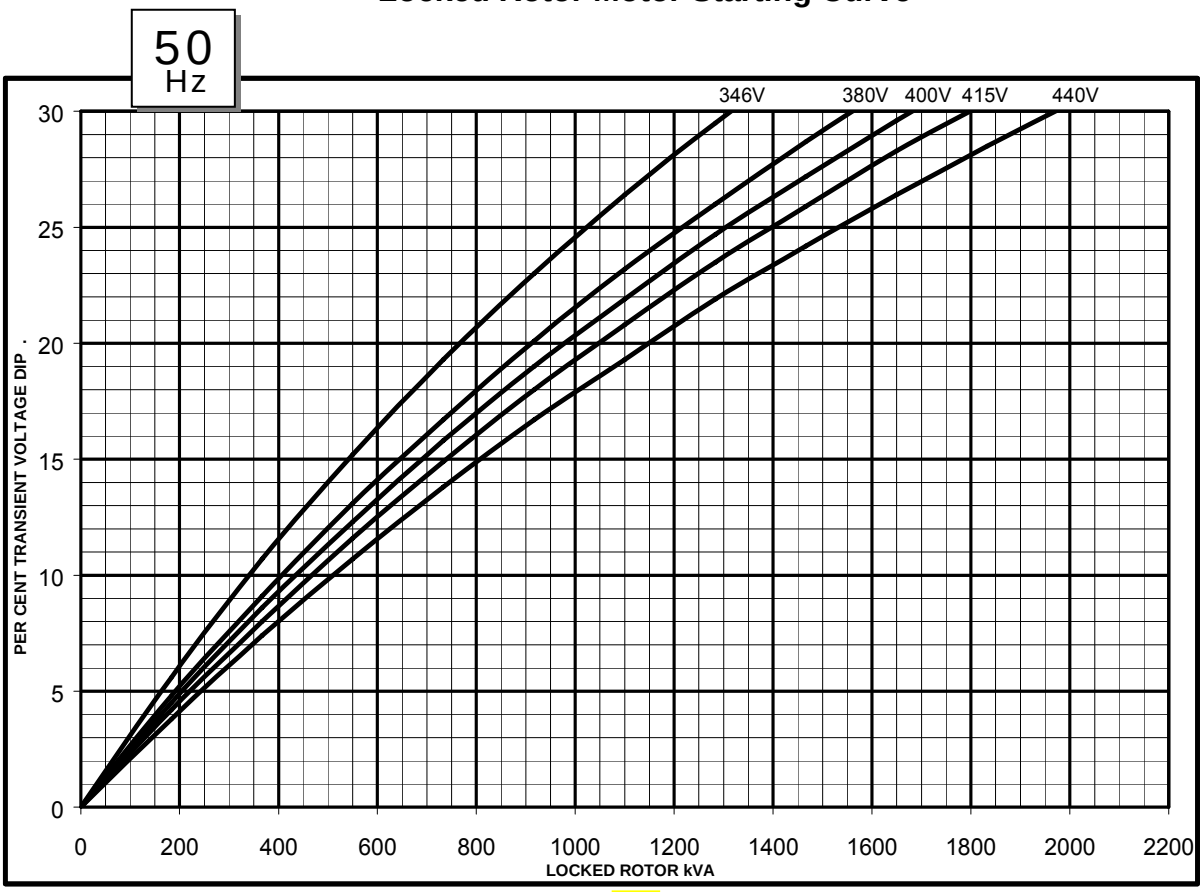


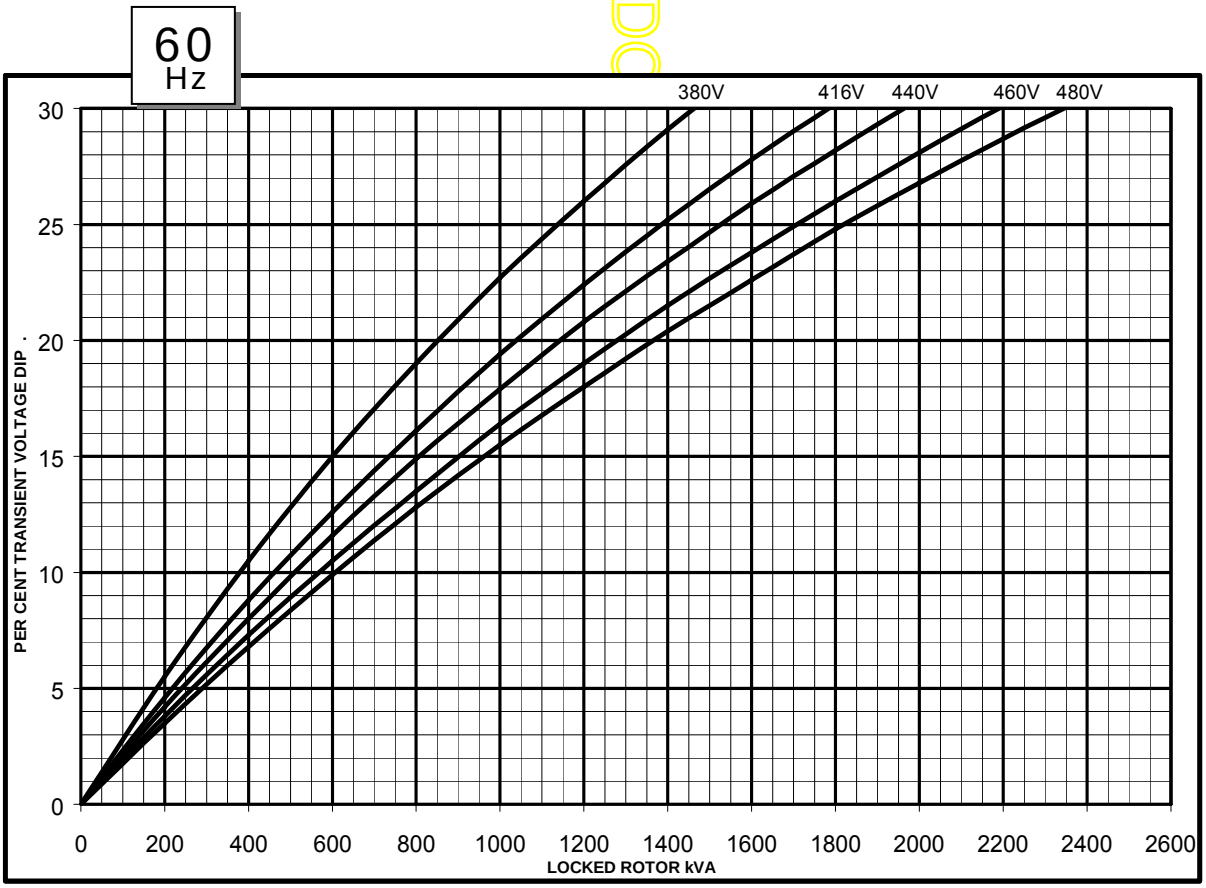






Locked Rotor Motor Starting Curve





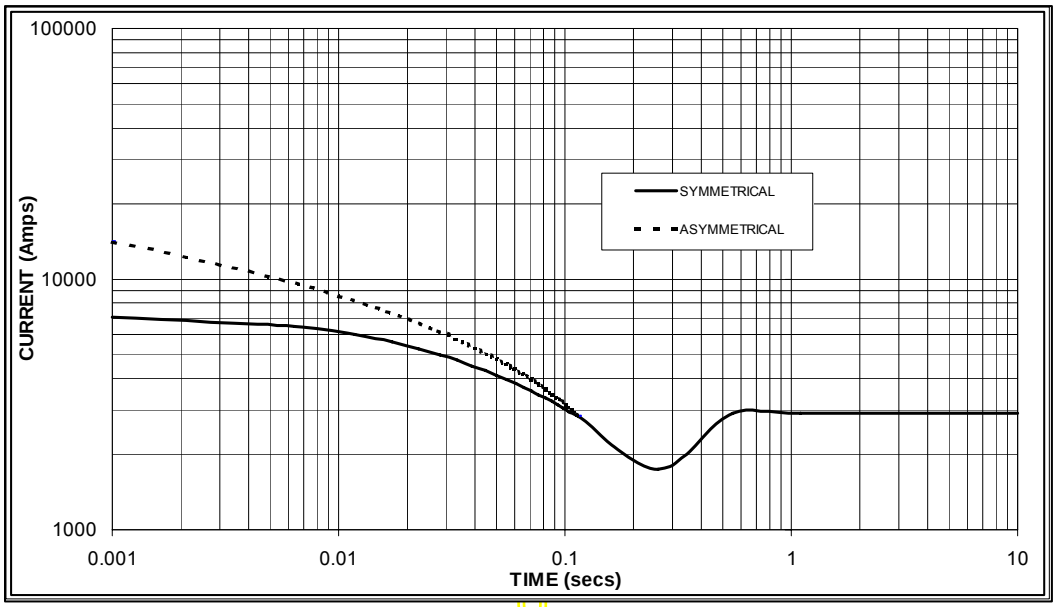
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WINDING 311 and 312

Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed

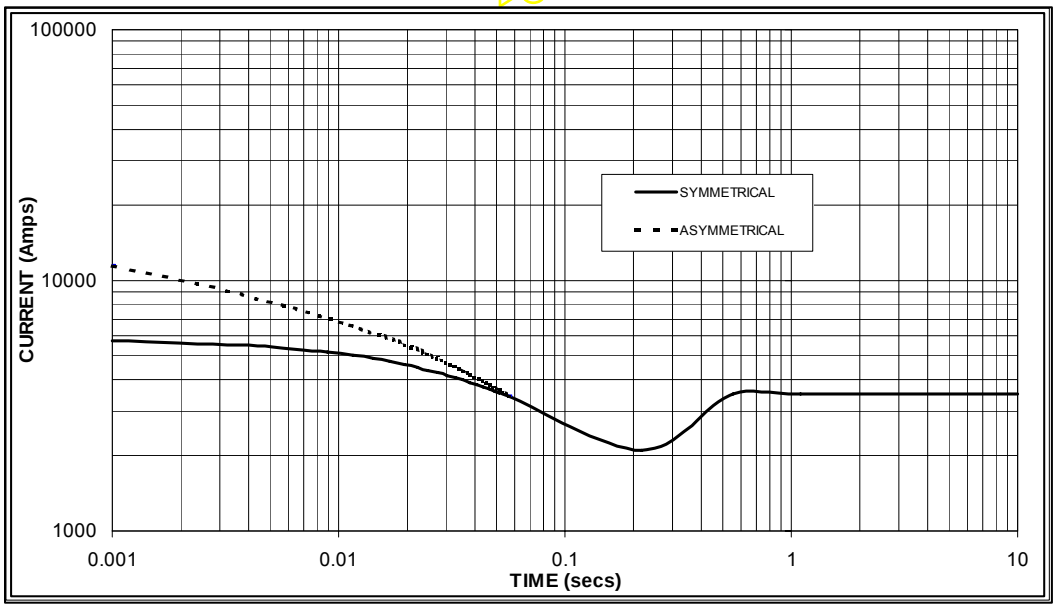
Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 2,900 Amps

60 Hz



Sustained Short Circuit = 3,500 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	X 1.00	416v	x 1.00
400v	X 1.07	440v	x 1.06
415v	X 1.12	460v	x 1.12
440v	X 1.18	480v	x 1.17

The sustained current value is constant irrespective of voltage level

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines. For Delta connection multiply the Curve current value by 1.732

HCI634G

Winding 311 and 312 0.8 Power Factor

RATINGS

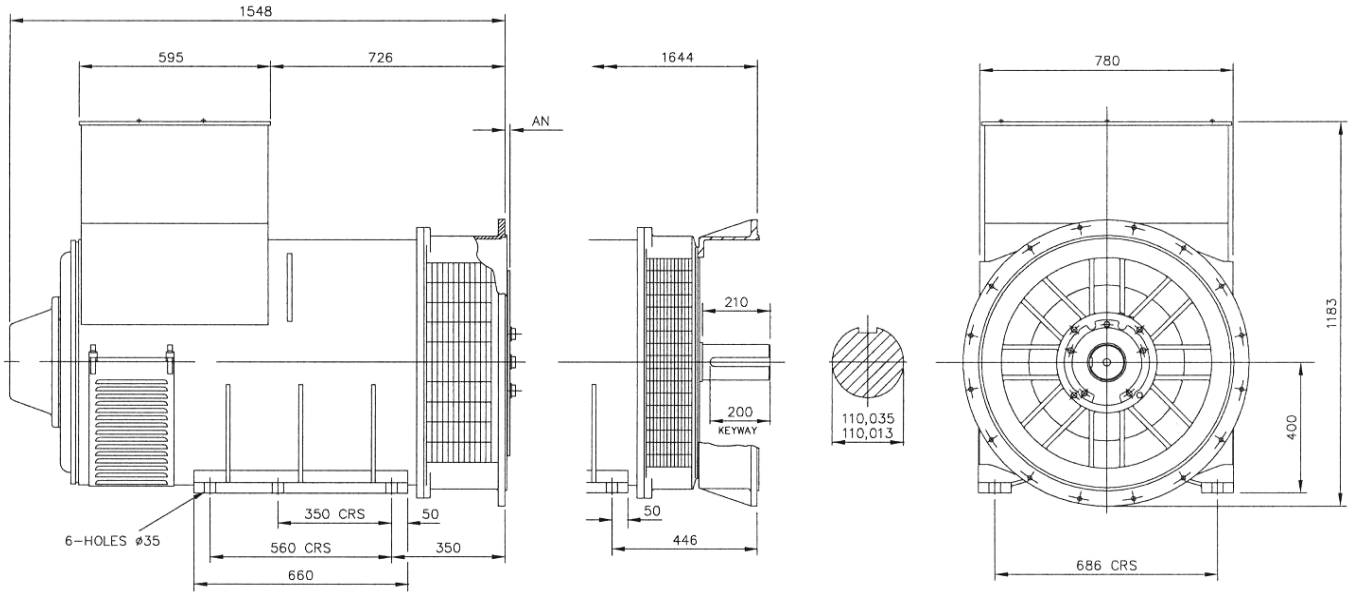
Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50Hz Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
Parallel Star (V) *	180	200	208	220	180	200	208	220	180	200	208	220	180	200	208	220
Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
kVA	750	760	750	750	800	810	800	800	825	830	825	820	850	860	850	850
kW	600	608	600	600	640	648	640	640	660	664	660	656	680	688	680	680
Efficiency (%)	94.5	94.6	94.8	95.0	94.2	94.4	94.6	94.8	94.1	94.3	94.5	94.7	93.9	94.2	94.4	94.6
kW Input	635	643	633	632	679	686	677	675	702	704	698	693	724	730	720	719

60Hz Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
Parallel Star (V) *	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
kVA	813	844	888	913	875	925	963	1000	913	969	1008	1046	950	1000	1044	1088
kW	650	675	710	730	700	740	770	800	730	775	806	837	760	800	835	870
Efficiency (%)	94.6	94.7	94.8	94.8	94.4	94.5	94.5	94.6	94.2	94.3	94.4	94.4	94.1	94.2	94.3	94.3
kW Input	688	713	749	770	742	783	815	846	775	822	854	886	808	849	886	923

* Parallel Star only available with Wdg 311

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DIMENSIONS



SAE	14	18	21	24
AN	25.4	15.87	0	0

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STAMFORD

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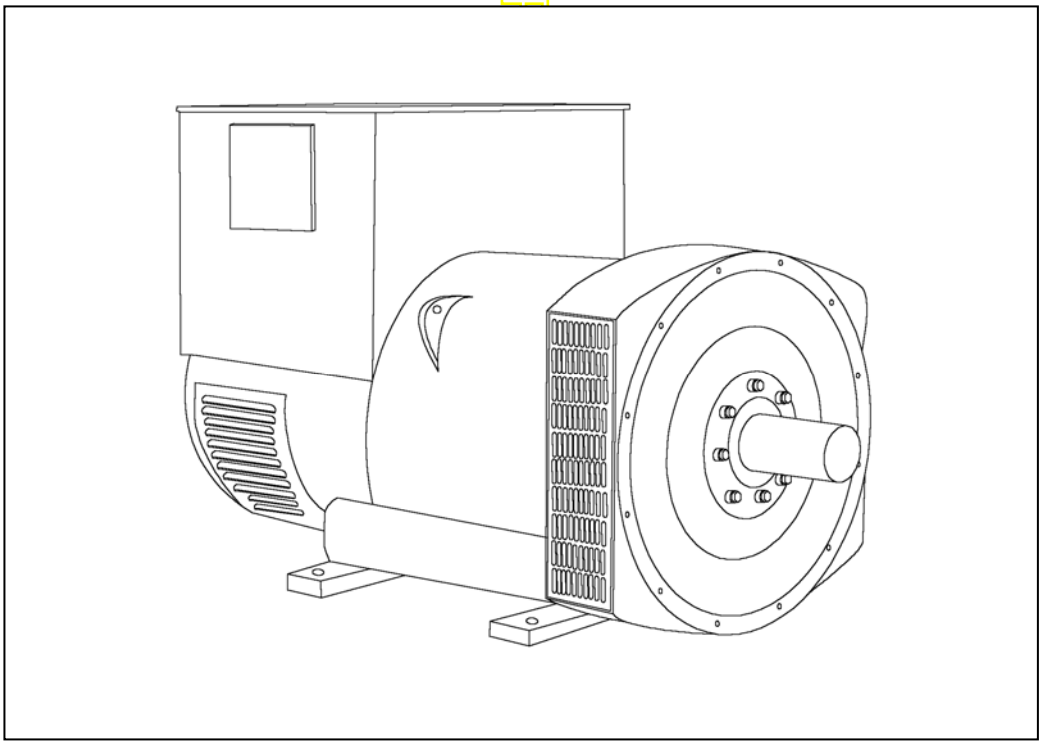
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STAMFORD®

HCI 534F/544F - Winding 311

Technical Data Sheet



SPECIFICATIONS & OPTIONS

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2 100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

AS440 AVR - STANDARD

With this self-excited system the main stator provides power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor.
The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.
If three-phase sensing is required with the PMG system the MX321 AVR must be used.
We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5°C by which the operational ambient temperature exceeds 40°C.
Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

APPROVED DOCUMENT

WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED	
A.V.R.	AS440	
VOLTAGE REGULATION	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT	

INSULATION SYSTEM	CLASS H						
PROTECTION	IP23						
RATED POWER FACTOR	0.8						
STATOR WINDING	DOUBLE LAYER LAP						
WINDING PITCH	TWO THIRDS						
WINDING LEADS	12						
STATOR WDG. RESISTANCE	0.0037 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED						
ROTOR WDG. RESISTANCE	2.16 Ohms at 22°C						
EXCITER STATOR RESISTANCE	17 Ohms at 22°C						
EXCITER ROTOR RESISTANCE	0.092 Ohms PER PHASE AT 22°C						
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others						
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%						
MAXIMUM OVERSPEED	2250 Rev/Min						
BEARING DRIVE END	BALL. 6220 (ISO)						
BEARING NON-DRIVE END	BALL. 6314 (ISO)						
	1 BEARING				2 BEARING		
WEIGHT COMP. GENERATOR	1685 kg				1694 kg		
WEIGHT WOUND STATOR	805 kg				805 kg		
WEIGHT WOUND ROTOR	684 kg				655 kg		
WR² INERTIA	10.033 kgm²				9.7551 kgm²		
SHIPPING WEIGHTS in a crate	1775 kg				1780kg		
PACKING CRATE SIZE	166 x 87 x 124(cm)				166 x 87 x 124(cm)		
	50 Hz				60 Hz		
TELEPHONE INTERFERENCE	THF<2%				TIF<50		
COOLING AIR	1.035 m³/sec 2202 cfm				1.312 m³/sec 2780 cfm		
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
kVA BASE RATING FOR REACTANCE VALUES	670	670	670	650	738	775	800	825
Xd DIR. AXIS SYNCHRONOUS	2.90	2.62	2.43	2.10	3.33	3.13	2.95	2.80
X'd DIR. AXIS TRANSIENT	0.16	0.14	0.13	0.11	0.16	0.15	0.14	0.13
X"d DIR. AXIS SUBTRANSIENT	0.11	0.10	0.09	0.08	0.11	0.10	0.10	0.09
Xq QUAD. AXIS REACTANCE	2.42	2.19	2.03	1.75	2.66	2.50	2.36	2.23
X"q QUAD. AXIS SUBTRANSIENT	0.25	0.23	0.21	0.18	0.31	0.29	0.27	0.26
X_L LEAKAGE REACTANCE	0.05	0.04	0.04	0.03	0.05	0.05	0.04	0.04
X_2 NEGATIVE SEQUENCE	0.18	0.16	0.15	0.13	0.21	0.20	0.19	0.18
X_0 ZERO SEQUENCE	0.08	0.08	0.07	0.06	0.09	0.08	0.08	0.08
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED						
T'd TRANSIENT TIME CONST.	0.08s						
T"d SUB-TRANSTIME CONST.	0.012s						
T'do O.C. FIELD TIME CONST.	2.5s						
Ta ARMATURE TIME CONST.	0.019s						
SHORT CIRCUIT RATIO	1/Xd						

APPROVED DOCUMENT

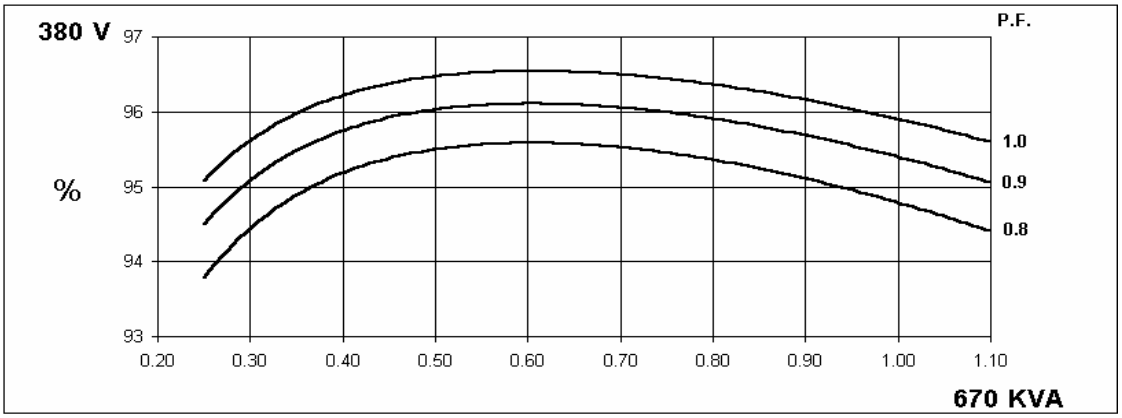
50 Hz

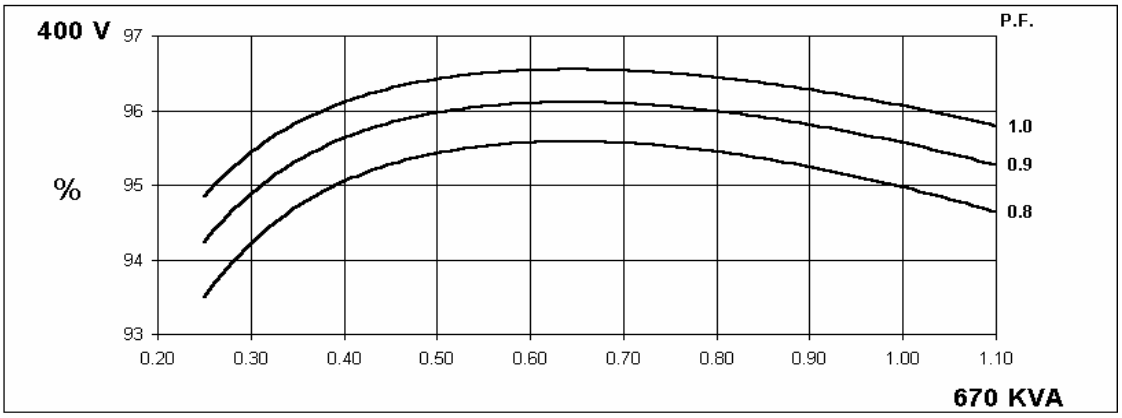
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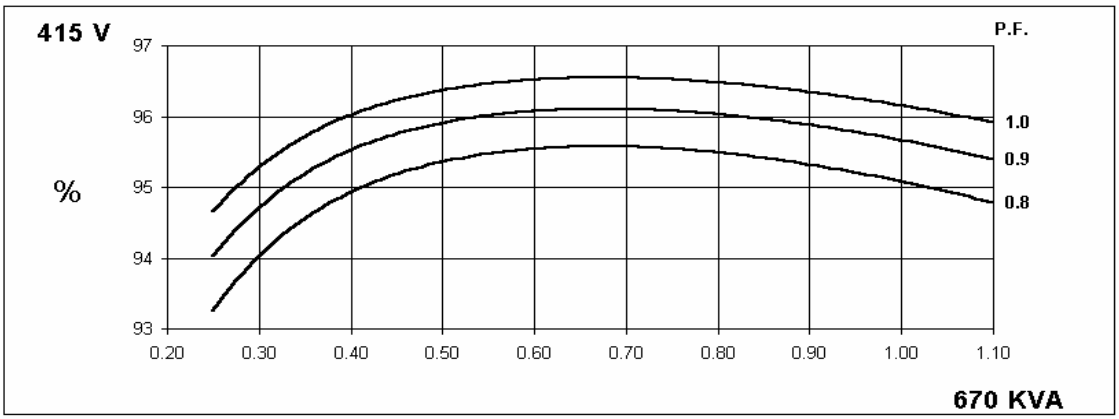
Winding 311

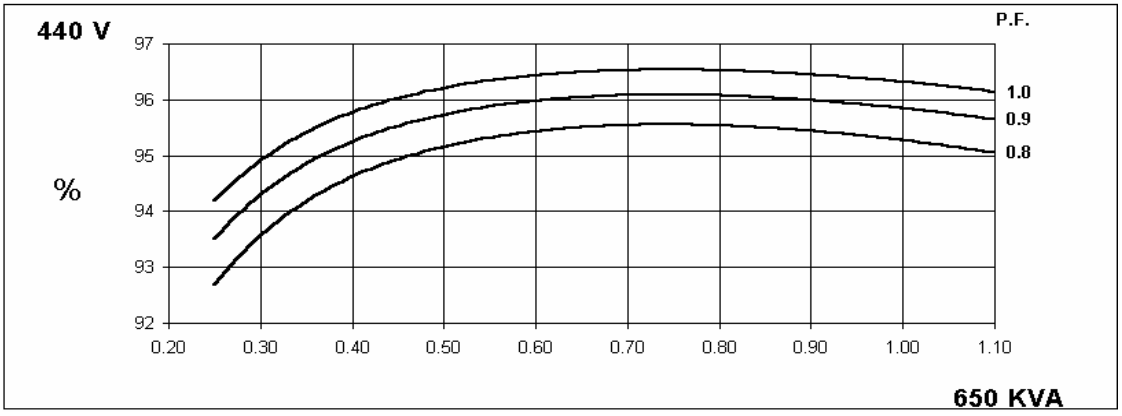
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THREE PHASE EFFICIENCY CURVES









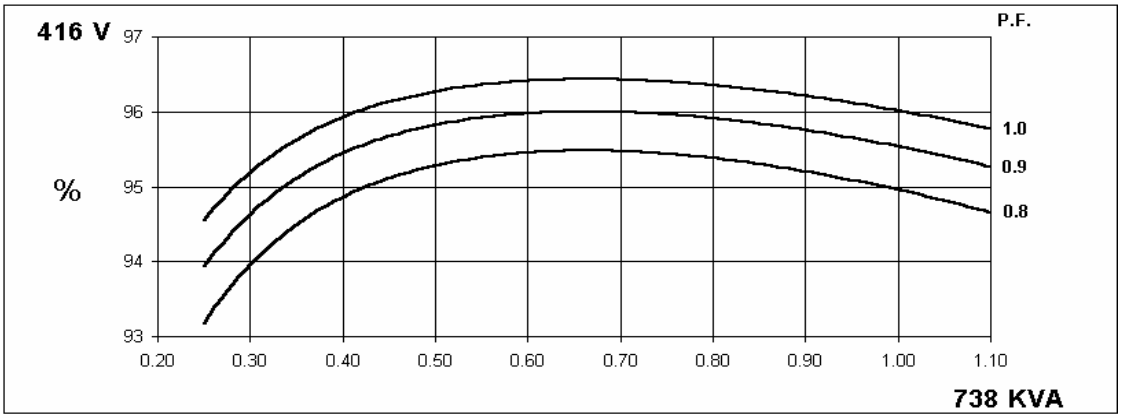
60 Hz

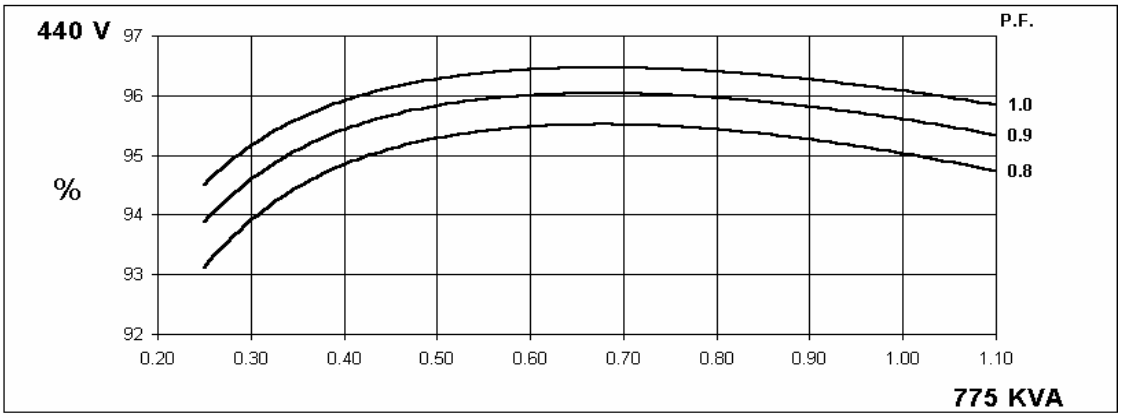
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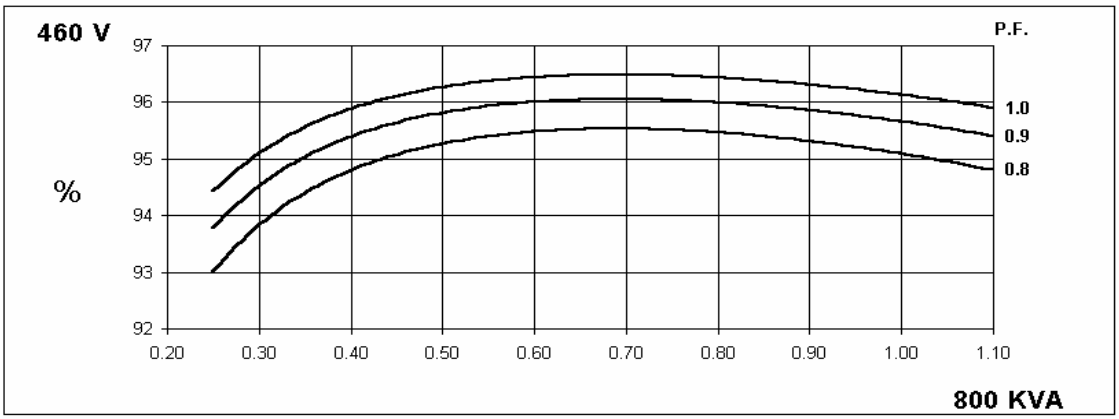
Winding 311

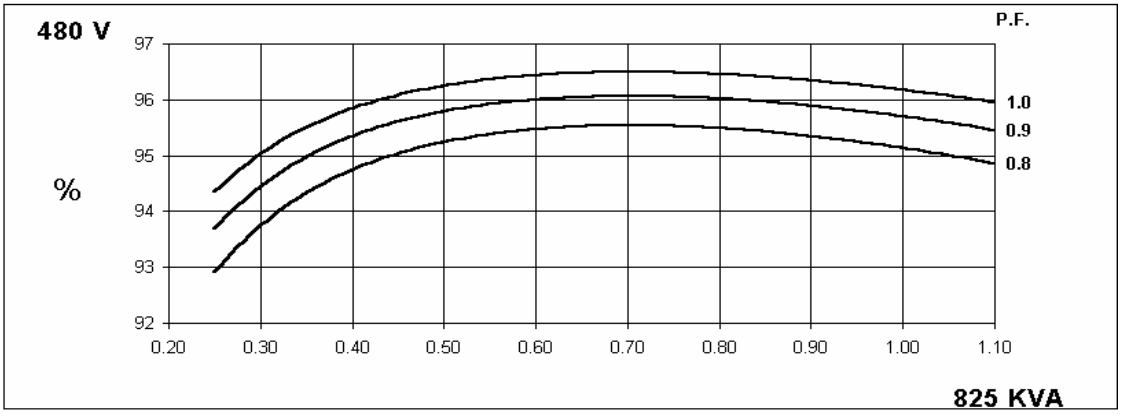
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THREE PHASE EFFICIENCY CURVES









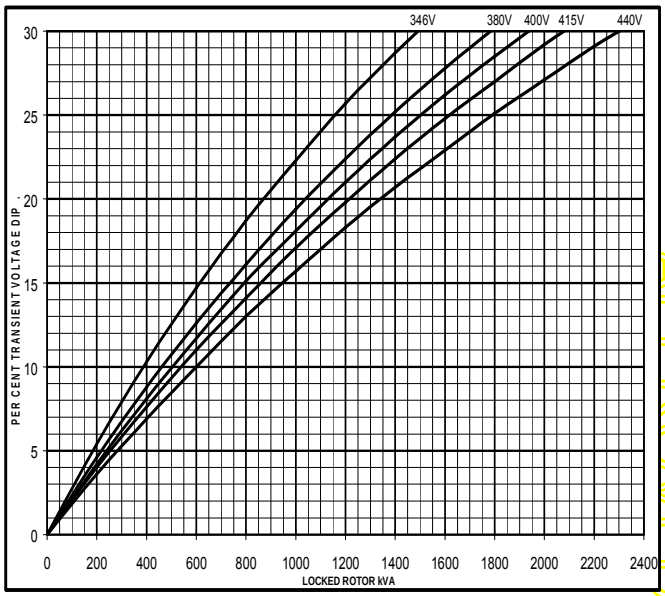
HCI534F/544F

Winding 311

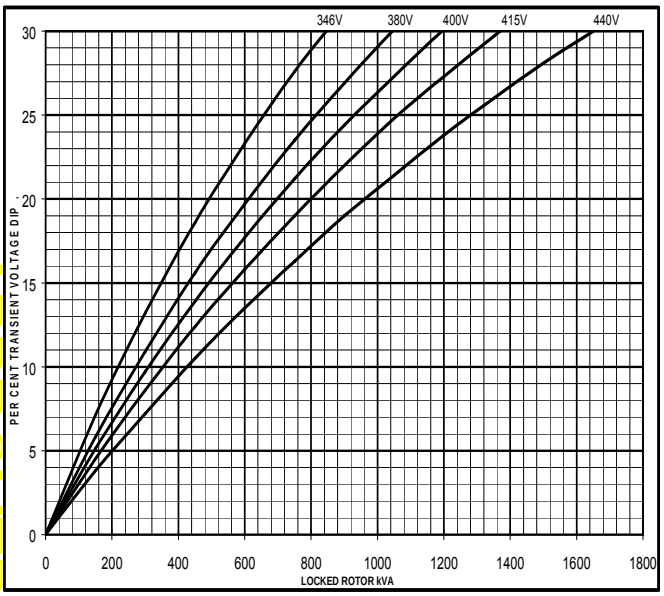
Locked Rotor Motor Starting Curve

50 Hz

MX



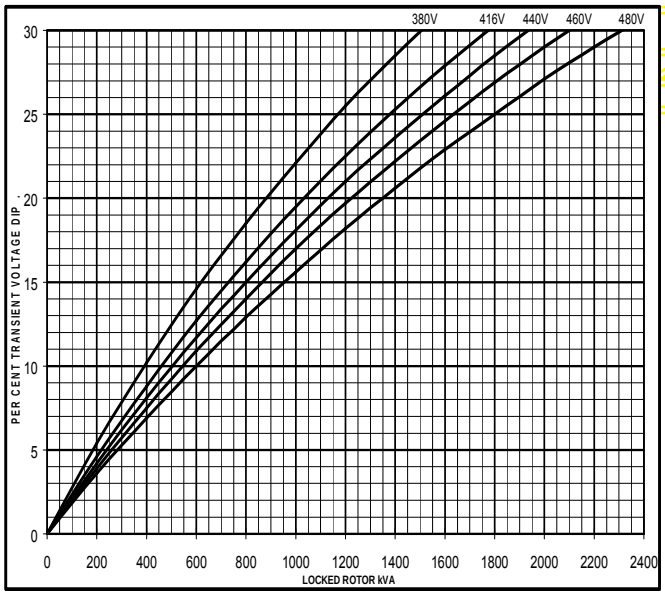
SX



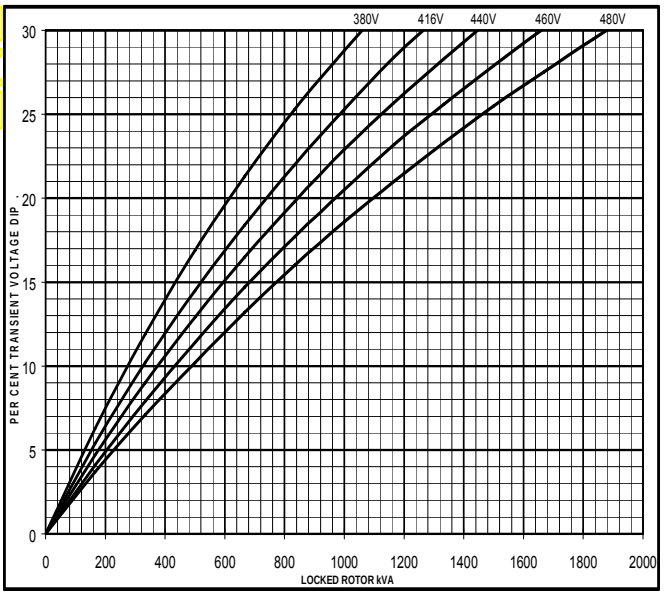
APPROVED DOCUMENT

60 Hz

MX

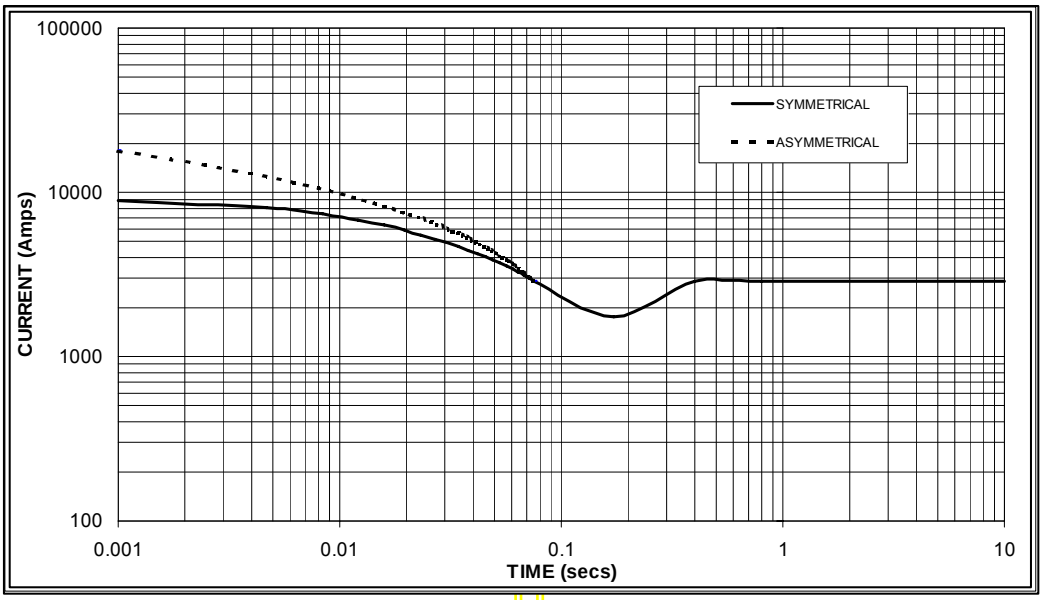


SX



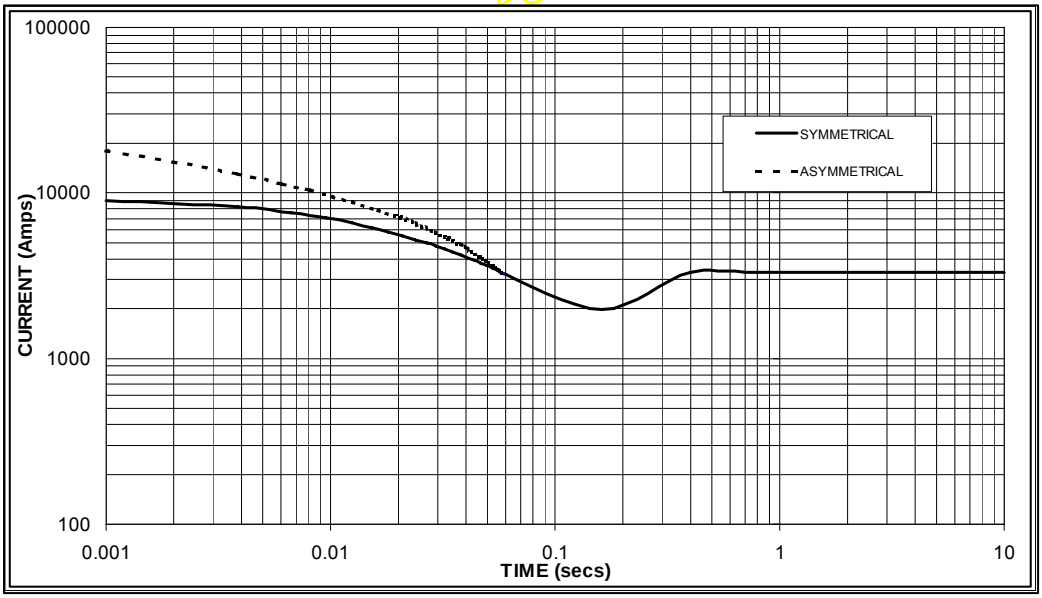
Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 2,900 Amps

60 Hz



Sustained Short Circuit = 3,300 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	X 1.00	416v	X 1.00
400v	X 1.06	440v	X 1.06
415v	X 1.09	460v	X 1.12
440v	X 1.12	480v	X 1.20

The sustained current value is constant irrespective of voltage level

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines. For other connections the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

HCI534F/544F

Winding 311 0.8 Power Factor

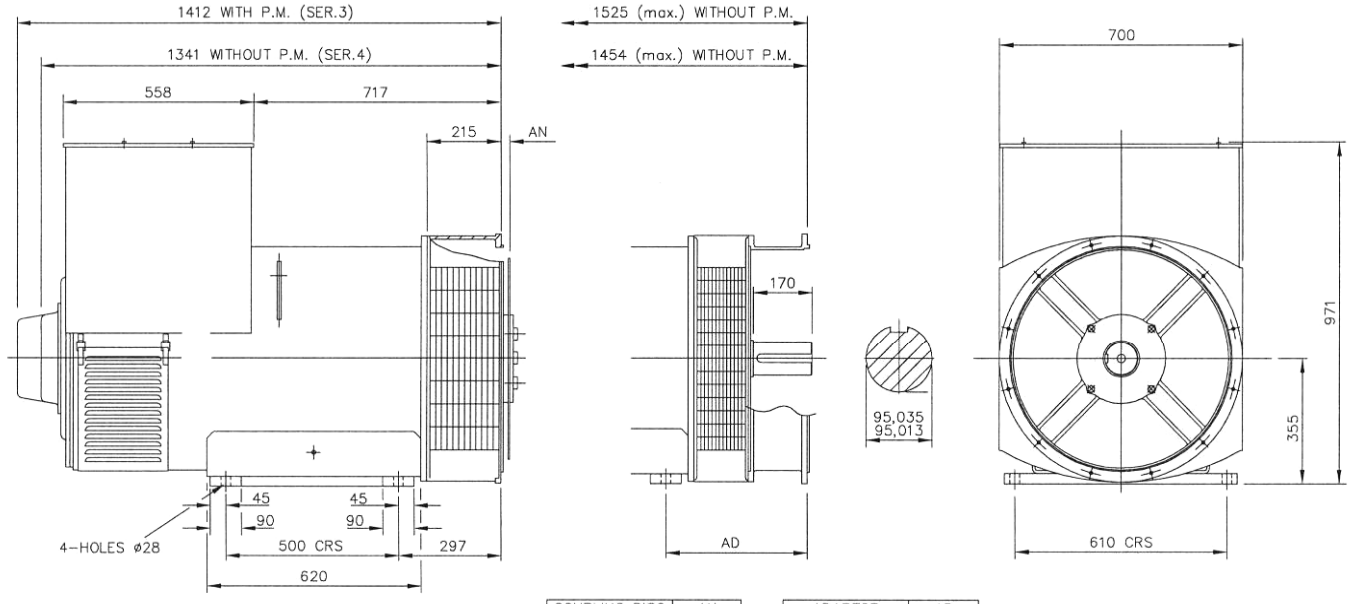
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RATINGS

	Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	620	620	620	600	670	670	670	650	710	710	710	690	738	738	738	715
	kW	496	496	496	480	536	536	536	520	568	568	568	552	590	590	590	572
	Efficiency (%)	95.0	95.2	95.3	95.4	94.8	95.0	95.1	95.3	94.6	94.8	94.9	95.1	94.4	94.6	94.8	95.1
	kW Input	522	521	520	503	565	564	564	546	600	599	599	580	625	624	623	601
60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	688	719	731	750	738	775	800	825	781	819	848	875	806	844	878	906
	kW	550	575	585	600	590	620	640	660	625	655	678	700	645	675	702	725
	Efficiency (%)	95.1	95.2	95.3	95.3	95.0	95.0	95.1	95.1	94.8	94.9	94.9	95.0	94.7	94.8	94.8	94.9
	kW Input	579	604	614	630	621	653	673	694	659	690	715	737	681	712	741	764

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DIMENSIONS



COUPLING DISC	AN
SAE 14	25,4
SAE 18	15,87
SAE 21	0

ADAPTOR	AD
SAE 00	410
SAE 0	410
SAE 1/2	390
SAE 1	390

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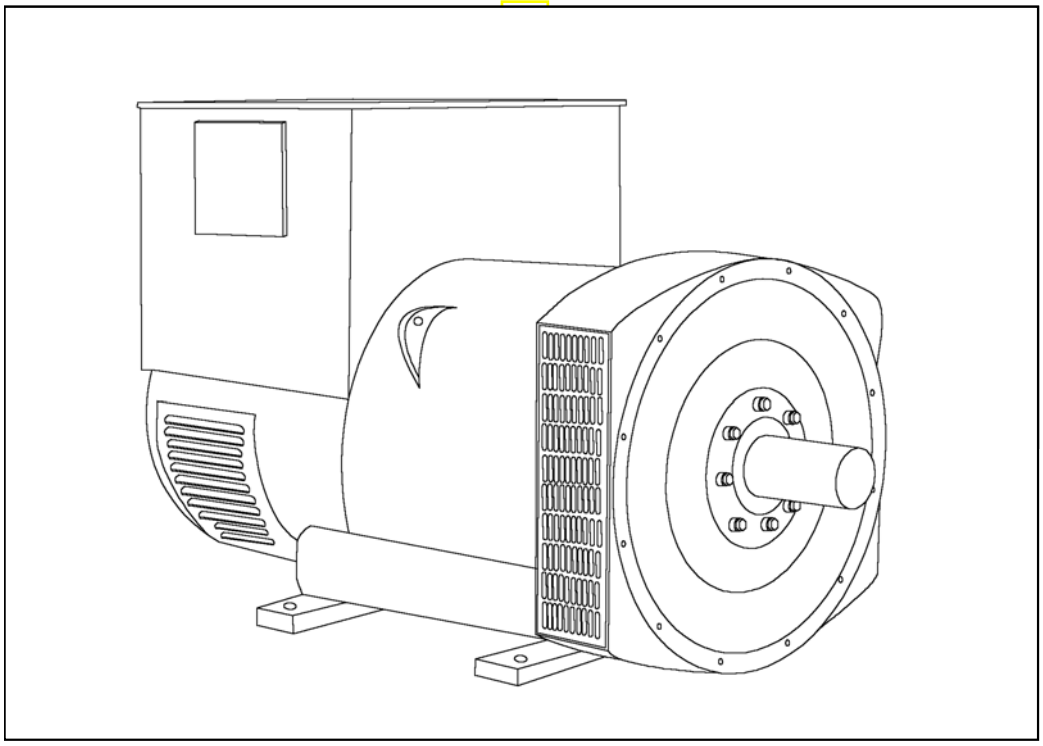
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HCI534F/544F - Winding 17

Technical Data Sheet



SPECIFICATIONS & OPTIONS

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.
Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

AS440 AVR - STANDARD

With this self-excited system the main stator provides power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.
The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.
The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.
An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.
If three-phase sensing is required with the PMG system the MX321 AVR must be used.
We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.
Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

INSULATION/IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

DE RATES

All values tabulated on page 6 are subject to the following reductions

5% when air inlet filters are fitted.
3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.
3% for every 5 C by which the operational ambient temperature exceeds 40 C.
Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.

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WINDING 17

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 5)		

CONTROL SYSTEM	SELF EXCITED	
A.V.R.	AS440	
VOLTAGE REGULATION	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	WILL NOT SUSTAIN A SHORT CIRCUIT	

INSULATION SYSTEM	CLASS H	
PROTECTION	IP23	
RATED POWER FACTOR	0.8	
STATOR WINDING	DOUBLE LAYER LAP	
WINDING PITCH	TWO THIRDS	
WINDING LEADS	12	
STATOR WDG. RESISTANCE	0.0049 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED	
ROTOR WDG. RESISTANCE	2.16 Ohms at 22°C	
EXCITER STATOR RESISTANCE	17 Ohms at 22°C	
EXCITER ROTOR RESISTANCE	0.092 Ohms PER PHASE AT 22°C	
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others	
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%	
MAXIMUM OVERSPEED	2250 Rev/Min	
BEARING DRIVE END	BALL. 6220 (ISO)	
BEARING NON-DRIVE END	BALL. 6314 (ISO)	
	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	1685 kg	1694 kg
WEIGHT WOUND STATOR	805 kg	805 kg
WEIGHT WOUND ROTOR	684 kg	655 kg
WR² INERTIA	10.033 kgm^2	9.7551 kgm^2
SHIPPING WEIGHTS in a crate	1775 kg	1780 kg
PACKING CRATE SIZE	166 x 87 x 124 (cm)	166 x 87 x 124 (cm)
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	1.035 m³/sec 2202 cfm	
VOLTAGE SERIES STAR	600V	
VOLTAGE PARALLEL STAR	300V	
VOLTAGE SERIES DELTA	346V	
kVA BASE RATING FOR REACTANCE VALUES	825	
Xd DIR. AXIS SYNCHRONOUS	2.44	
X'd DIR. AXIS TRANSIENT	0.11	
X"d DIR. AXIS SUBTRANSIENT	0.09	
Xq QUAD. AXIS REACTANCE	1.95	
X"q QUAD. AXIS SUBTRANSIENT	0.23	
X_L LEAKAGE REACTANCE	0.04	
X_2 NEGATIVE SEQUENCE	0.16	
X_0 ZERO SEQUENCE	0.07	
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.	0.08 s	
T"d SUB-TRANSTIME CONST.	0.012 s	
T'do O.C. FIELD TIME CONST.	2.5 s	
Ta ARMATURE TIME CONST.	0.019 s	
SHORT CIRCUIT RATIO	1/Xd	

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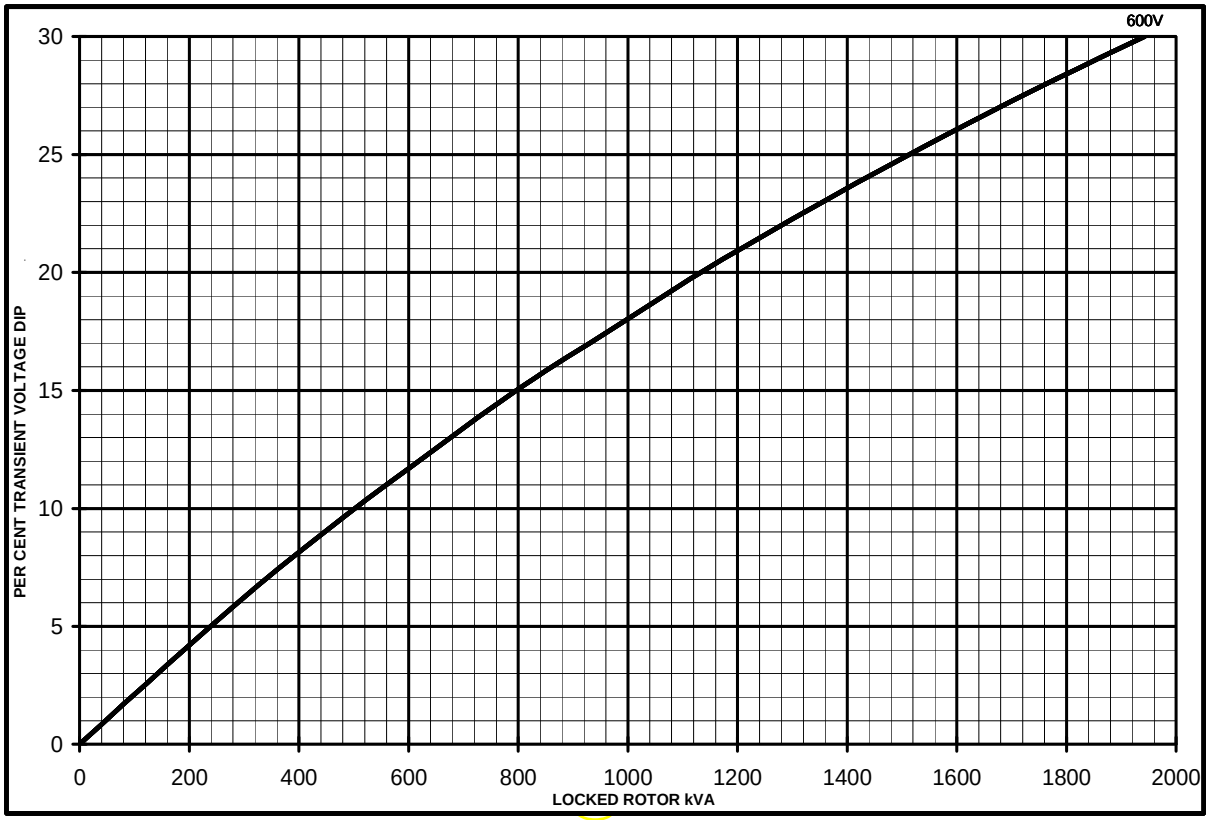
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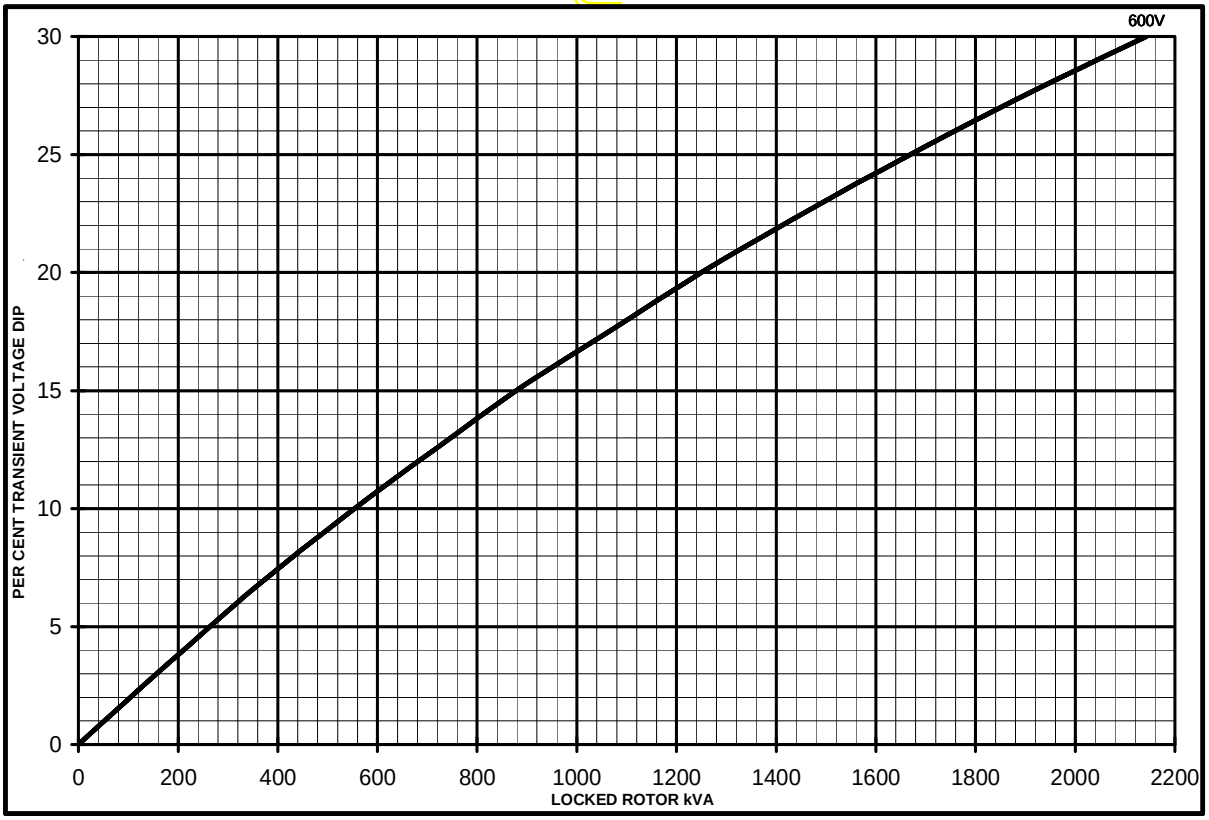
Winding 17

SX

Locked Rotor Motor Starting Curves

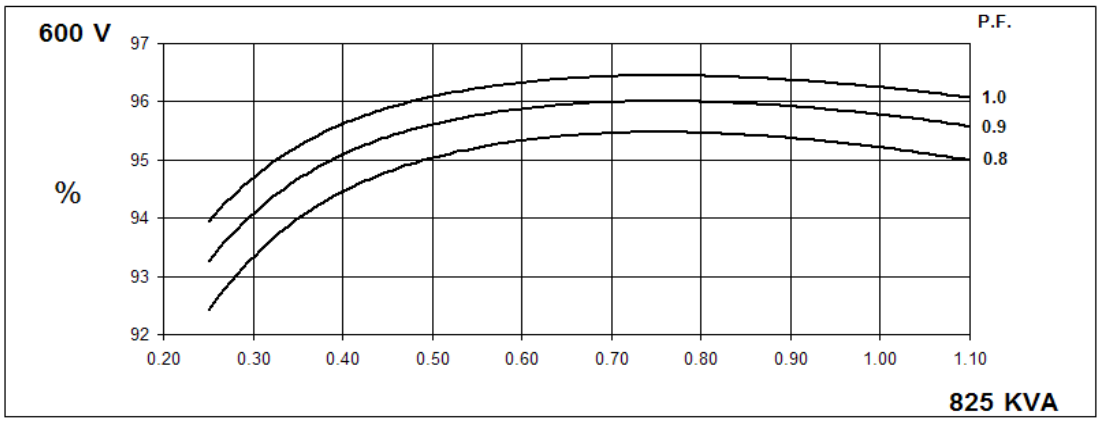


MX



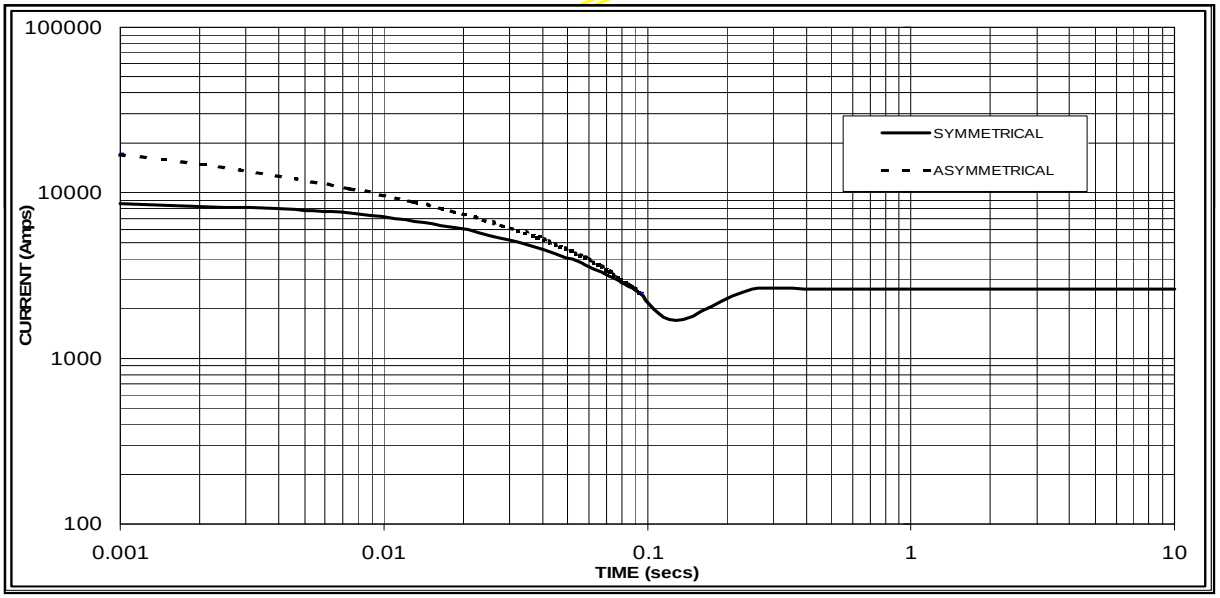
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THREE PHASE EFFICIENCY CURVES



Copy

Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.



Sustained Short Circuit = 2600 Amps

Note
The following multiplication factor should be used to convert the values from curve for the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

HCI534F/544F

Winding 17 / 0.8 Power Factor

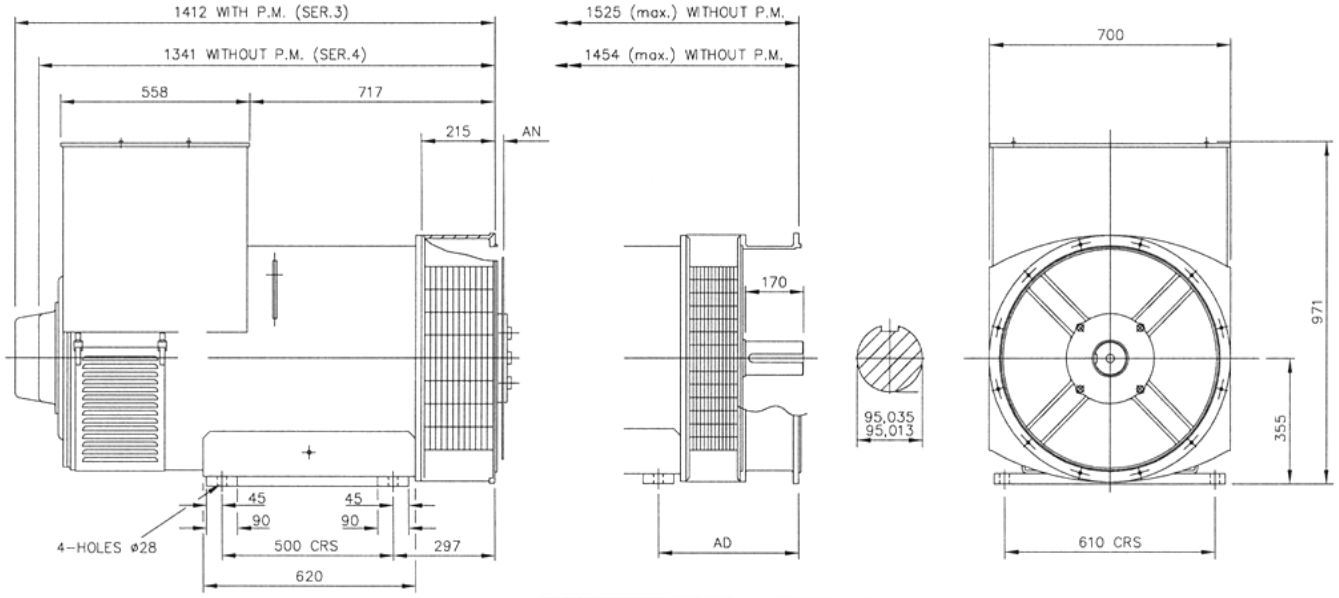
60Hz

RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Series Star (V)	600	600	600	600
Parallel Star (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	750	825	875	906
kW	600	660	700	725
Efficiency (%)	95.4	95.2	95.1	95.0
kW Input	629	692	734	760

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DIMENSIONS



COUPLING DISC	AN
SAE 14	25,4
SAE 18	15,87
SAE 21	0

ADAPTOR	AD
SAE 00	410
SAE 0	410
SAE 1/2	390
SAE 1	390

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DGC-2020 Digital Genset Controller







A highly advanced integrated genset control system, this device provides genset control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.

Features

- Generator metering (includes three-phase mains)
- Engine and generator protection: 27, 32R, 40Q, 59, 81O/U
- Optional enhanced generator protection: 47, 51, 78, and 81ROCOF
- Load sharing and generator sequencing (via LSM-2020 Load Share Module)
- Var sharing over Ethernet (via LSM-2020)
- BESTCOMS*Plus*® Software
  - Programming and setup
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable logic
  - USB communications
- Automatic transfer switch control
- Automatic synchronizer (optional)
- Exercise timer
- SAE J1939 engine ECU communications
- Automatic generator configuration detection
- Expandable functionality via add-on modules
  - LSM-2020 Load Share Module
  - CEM-2020 Contact Expansion Module
  - AEM-2020 Analog Expansion Module
- Multilingual capability
- Remote communications to Basler's RDP-110 (remote display panel)
- Sixteen programmable contact inputs
- Up to 15 contact outputs: 3 contacts rated for 30 Adc and up to 12 programmable contacts rated for 2 Adc

Visit www.basler.com for additional information.

Benefits

- Provides integrated engine-genset control, protection, and metering in a single package.
- The Offline Simulator, provided in BESTlogic™*Plus*, helps test and troubleshoot logic without the need for expensive hardware.
- Flexible programmable logic and programmable I/O make it easy to expand the DGC-2020's inputs and outputs with the CEM-2020 (Contact Expansion Module) and the AEM-2020 (Analog Expansion Module). This saves time and money by eliminating unnecessary external PLCs and control relaying.

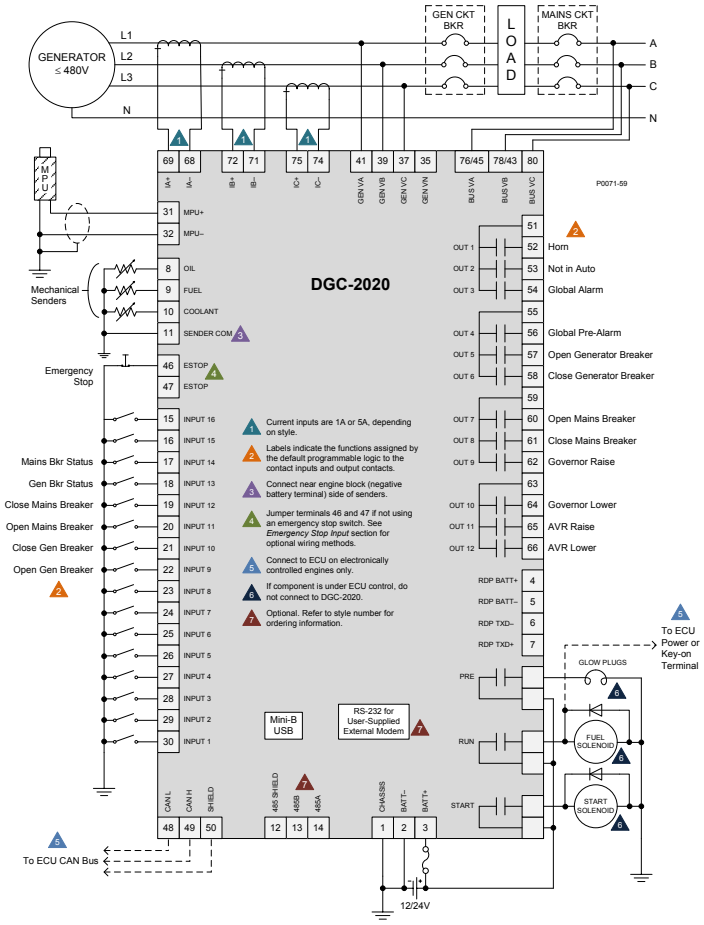


Figure 1 - DGC-2020 Connection Diagram for a Typical Application

Specifications

Power Supply

Nominal:	12 or 24 Vdc
Range:	6 to 32 Vdc
Battery Ride Through:	Starting at 10 Vdc, withstands cranking ride-through down to 0 V for 50 ms

Power Consumption

Sleep Mode:	5 W
Normal Operational Mode:	7.9 W
Maximum:	14.2 W

Current Sensing

1 A Sensing:	0.02 to 1.0 Aac, continuous 2 Aac for 1 second
5 A Sensing:	0.1 to 5.0 Aac, continuous 10 Aac for 1 second
Burden:	1 VA

Voltage Sensing

Range:	12 to 576 Vrms L-L
Frequency Range:	10 to 72 Hz for 50/60 Hz style, 10 to 480 Hz for 400 Hz style
Burden:	1 VA
One-second Rating:	720 Vrms

Contact Sensing

Contact Inputs (16):	Accepts normally open (N.O.), Dry Contacts, programmable
Emergency Stop:	Normally closed (N.C.), Dry Contact

Engine Speed Sensing

Magnetic Pickup:	
Voltage Range:	6 to 70 Vpp
Frequency Range:	32 to 10,000 Hz
Generator Frequency:	
Generator Voltage Range:	12 to 576 Vrms
Via ECU over J1939	

Resistive Senders

Fuel Level Sender:	0 to 250 Ω nominal
Coolant Temp Sender:	10 to 2,750 Ω nominal
Oil Pressure Sender:	0 to 250 Ω nominal

Output Contacts

Fuel Solenoid, Engine Crank, Pre-Start Relays Rating:	30 Adc at 28 Vdc-make, break, and carry
Programmable Relays:	Up to 12
Rating:	2 Adc at 28 Vdc-make, break, and carry

Protection

Generator:	27, 32R, 40Q, 59, 81O/U (standard) 47, 51, 78, 81 ROCOF (optional)
Engine:	Oil pressure, coolant temperature, overcrank, ECU-specific elements, and diagnostic reporting.

Agency Approvals

CSA certified, NFPA compliant, CE compliant, UL recognized (Hazardous Location certification available upon request), EAC certified

Communication

USB Port:	USB 2.0, Mini-B jack
RS-485 (optional):	9600 baud, 8 data bits, no parity
RDP-110 (optional):	4,000 ft (1,219 m) max wire length, 20 AWG (0.52 mm²) min wire size
Modem (optional):	DB-9 connector (male)
CAN bus:	250 kb/s communication rate, 1.5 to 3 Vdc differential bus

Environmental

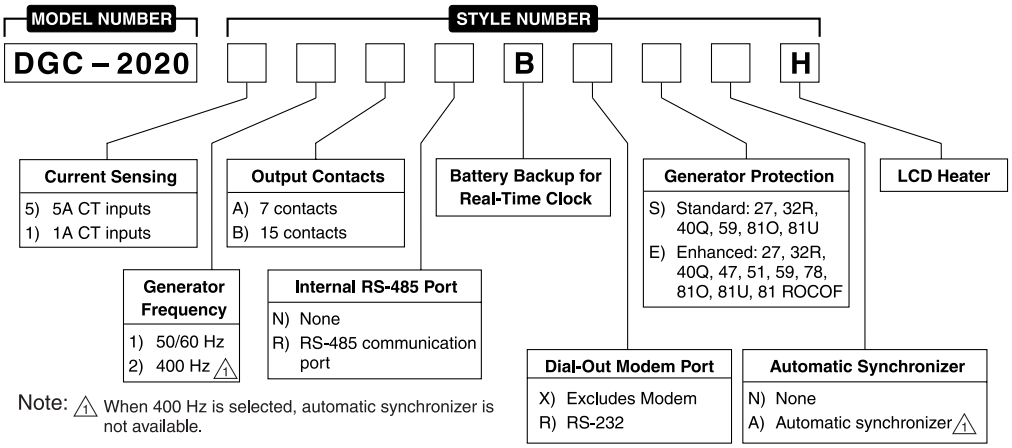
Operating Temp:	-40°C to 70°C (-40°F to 158°F)
Storage Temp:	-40°C to 85°C (-40°F to 185°F)
Humidity:	IEC 68-2-38
Salt Fog:	ASTM B 17-73, IEC 68-2-11
Ingress Protection:	IEC IP54 for front panel
Shock:	15 G in three perpendicular planes
Vibration:	
5 to 29 Hz:	1.5 G peak
29 to 52 Hz:	0.036″ (0.914 mm) double amplitude
52 to 500 Hz:	5 G peak

Physical

Weight:	4.4 lb (2 kg)
Dimensions (WxHxD):	11.77 x 8.27 x 2.69 inches (299 x 210 x 69 mm)

For complete specifications, download the instruction manual at www.basler.com.

Style Chart



Note: 1 When 400 Hz is selected, automatic synchronizer is not available.

Related Products

- BE1-11*g* Generator Protection System
  - A complete generator protection system.
- DECS-250 Digital Excitation Control System
  - Total control in a compact package provides precise voltage, var and power factor regulation, exceptional system response, and generator protection.

Accessories

- AEM-2020 Analog Expansion Module
  - Easily increases the functionality by seamlessly adding analog inputs and outputs.
- CEM-2020, CEM-2020H Contact Expansion Module
  - Each module adds 10 inputs and up to 24 outputs that are easily programmed through BESTCOMS*Plus*® for easy integration into the system.
- LSM-2020 Load Share Module
  - The simple-to-use LSM-2020 easily adds paralleling capabilities with little effort and expense.
- RDP-110 Remote Display Panel
  - Provides remote alarm and pre-alarm indication and annunciation of system status, easily meeting the annunciation requirements of NFPA-110 applications.

ISO 9001-2008
Highland, IL USA Wasselonne, France
Taylor, TX USA Suzhou, China
Basler Plastics, LLC

Basler Electric®
12570 State Route 143, Highland, Illinois 62249-1074 USA
Tel +1 618.654.2341 Fax +1 618.654.2351
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P.A.E. Les Pins, 67319 Wasselonne Cedex, FRANCE
Tel +33 3.88.87.1010 Fax +33 3.88.87.0808
e-mail: franceinfo@basler.com

No. 59 Heshun Road Loufeng District (N),
Suzhou Industrial Park, 215122, Suzhou, P.R.China
Tel +86(0)512.8227.2888 Fax +86(0)512.8227.2887
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111 North Bridge Road #15-06 Peninsula Plaza
Singapore 179098
Tel +65 68.44.6445 Fax +65 68.44.8902
e-mail: singaporeinfo@basler.com

Annex to the
technical catalog

Tmax T8

Low voltage molded case
circuit breaker up to 3000 A

UL 489 and CSA C22.2 Standard

1SDC210026D0201 – 2008 Edition



Main characteristics

The Tmax family, conforming to the UL 489 and CSA C22.2 No. 5.1 Standards, is enriched with the Tmax T8 size, which allows 3000 A to be reached. Also available in the 1600 A, 2000 A and 2500 A frames, Tmax T8 is equipped with the same electronic trip units as Tmax T7, thereby guaranteeing extremely high performances able to satisfy all installation requirements. Adequately sized for the performances offered (W=16.8 / D=11.2 / H=15.0 in). Tmax T8 is able to interrupt the following short-circuit currents: 125 kA@480 V and 100 kA@600 V.



Main characteristics

General characteristics

The Tmax T8 size has both circuit breakers and molded case switches (MCS). The following tables show the main characteristics of these ranges.

Circuit breakers for power distribution

				Tmax T8
Frame size			[A]	1600/2000/2500/3000
Number of poles			[No]	3/4
Rated voltage		(AC) 50-60 Hz	[V]	600
		(DC)	[V]	–
Test voltage (1 min) 50-60 Hz			[V]	3000
Interrupting ratings			[kA rms]	V
	240 V AC		[kA rms]	125
	480 V AC		[kA rms]	125
	600 V AC		[kA rms]	100
Trip units	Electronic	PR232/P-T8		■
		PR331/P		■
		PR332/P		■
Dimensions fixed version (3p)		H	[in-mm]	15.0 - 382
		W	[in-mm]	16.8 - 427
		D	[in-mm]	11.2 - 282
Mechanical life			[operations]	15000
Weight (fixed 3p)		1600/2000/2500 A	[lbs]	161
		3000 A	[lbs]	236

Molded case switches (MCS)

The Tmax T8 MCS are derived from the corresponding circuit breakers, of which they keep the overall dimensions, the versions, the fixing systems and the possibility of mounting accessories unchanged. This version only differs from the circuit breakers in the absence of the protection trip units. All molded case switches comply with the UL 489 and CSA C22.2 Standards and are self-protected.

			Tmax T8V-D
Rating		[A]	2000/2500/3000
Poles		[No]	3/4
Magnetic override		[A]	40000
Rated voltage	AC (50-60 Hz)	[V]	600
	DC	[V]	–

Tmax-Molded Case Circuit Breakers

T7 1200A Frame

AC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions	3P Fixed Version	10.55H x 8.26W x 6.06D
Weight	21.4 (lbs)	

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– "Low Voltage Directives" (LVD) no. 73/23 EEC
– "Electromagnetic Compatibility Directive" (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)	T7		
Continuous Current Rating	1200		
Number of Poles	3-4		
	S	**H**	**L**
AC			
240V	65	100	150
480V	50	65	100
600V	25	50	65

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

PR231/P, PR232/P, PR331DS, and PR332DS/P electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Padlock provision - PLL
- Direct rotary handle - RHD
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)

Publication LV114
No. 1SXU210114D0201
Printed in USA, April, 2008

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T6 800A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions	3P Fixed Version	10.55H x 8.26W x 4.07D
Weight	20.9 (lbs)	

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– "Low Voltage Directives" (LVD) no. 73/23 EEC
– "Electromagnetic Compatibility Directive" (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T6			
Continuous Current Rating		800			
Number of Poles		3-4			
		N	**S**	**H**	**L**
AC					
	240V	65	100	200	200
	480V	35	50	65	100
	600V	20	25	35	42
DC*					
	500V 2 poles in series	35	35	50	65
	600V 3 poles in series	20	20	35	50

*Thermal Magnetic Trip Only

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

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Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermal magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P, and PR222DS/PD-A electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)

Publication LV113
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ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Digital Linear Chargers

On-Board Chargers Today

- Current Supplier provides quality product and design services. However, services are at their pacing with limited resources; and a history of issues meeting launch dates. PC charger delays prompted a re-evaluation of our controls and processes
- Resulted in a renewed commitment to the charger category
    - Allow supplier to focus on what they do well… build product
    - All charger development controlled by Minn Kota engineering
- Minn Kota designs, tests, and qualifies
- Supplier manufactures – period
- Revised product plan
    - 2011 Digital Linear On-board chargers
    - 2012 Precision Charge On-board chargers

New Digital Linear On-Board Chargers

- Taking existing Linear On-board family of chargers and raising the bar
    - Analog to Digital designs; New “D” designation in model name

Digital± CONTROL



New Digital Linear On-Board Chargers (cont.)

- New microprocessor controlled linear design provides software enriched features and functionality
    - More repeatable set points (voltage limit and current) = improved charge curves
    - Maintenance mode time-out feature (auto-off)
    - Arc protection
    - Enhanced status codes
        - System okay
        - Charge stage indication (Bulk, Absorption, or Maintenance)
        - Full charge
        - Maintenance mode status
        - Multiple specific error indications – low battery voltage, damaged temp sensor, no output lead attached, etc.
- Up to 2X Faster Charge Times in high heat conditions

LED Status Code Detail

1. A GREEN power light is lit to indicate AC power is applied
2. A YELLOW light is lit for each bank to indicate the battery is charging in the Bulk Mode
3. A flashing YELLOW light is lit for each bank to indicate the battery is charging in the Absorption Mode
4. A flashing GREEN light is lit for each bank to indicate the battery is in maintenance mode and ready to use
5. A GREEN light is lit for each bank to indicate the battery is in long term maintenance mode and ready to use
6. A RED light for each bank is lit if any of the following apply:
    a) No battery is connected to an output cord - this may also indicate a blown fuse in the fuse holder
    b) The battery is connected reverse polarity
    c) A short circuit
    d) The battery voltage is below 4 volts - the bank will not charge a battery in this condition

LED Status Code Detail (cont.)

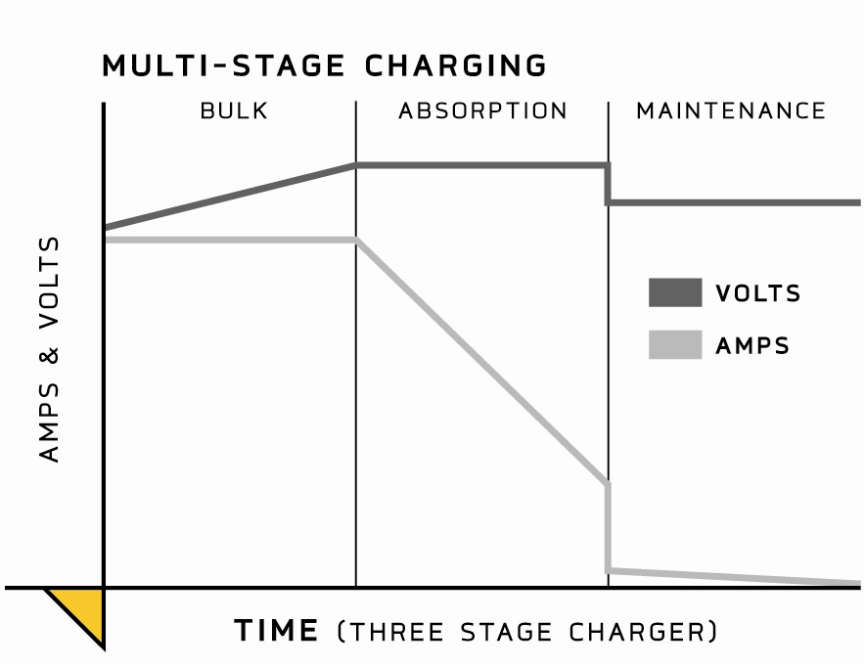
e) The battery voltage is above 18 volts - the bank will not charge a battery in this condition

7. A flashing RED light is lit for each bank if there is a damaged temperature sensor on the output cord - the bank will not operate if this occurs.
8. Flashing RED and GREEN lights are lit for each bank if any of the following apply:
   a) The battery voltage does not rise above 10.5V after 3 hours - the battery may be damaged and will not be charged
   b) Charging in Bulk Mode exceeds 20 hours - the battery may be damaged and will not be charged

Digital Linear Charging Technologies

Automatic 3-Stage Charging

- Bulk – high amps at low voltage until battery reaches ~75% charge
- Absorption – at ~75% charge, current tapers down until the battery voltage reaches 14.4V* (full charge)
- Maintenance (or Float) – when the battery voltage reaches full charge, charger output is dropped to 13.4V* (.1A-.3A). After 24 hours, the charger automatically turns off and automatically turns on when the battery voltage drops below 12.6 volts



* At 77 degrees Fahrenheit

Digital Linear Charging Technologies (cont.)

Automatic Temperature Compensation

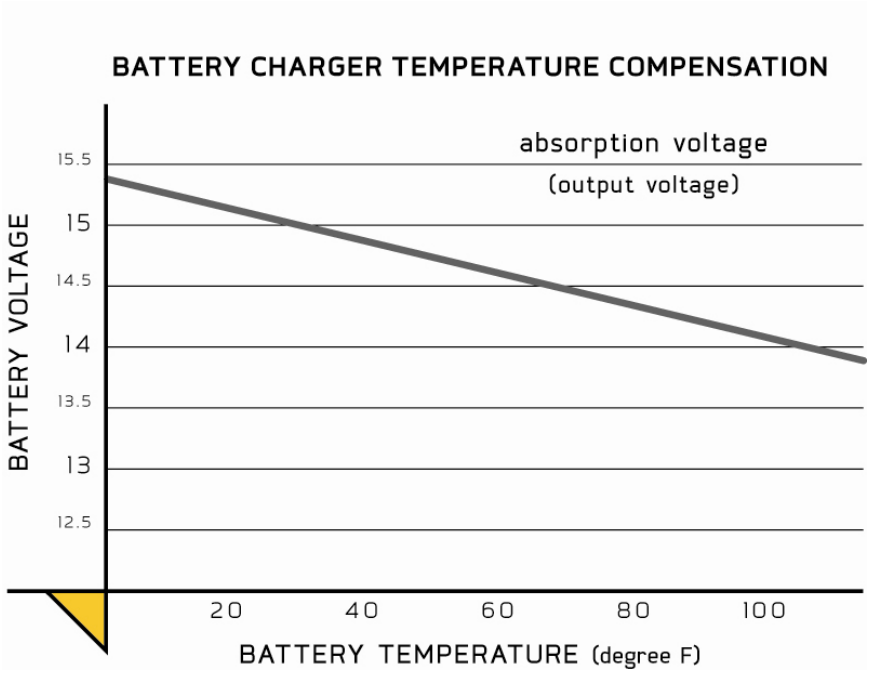
- Senses temperature and adjusts output voltage
- Protects batteries from overcharging at high temperatures
- Maintains gassing threshold for a full charge

Gassing Threshold

- Voltage level at which electrolyte begins moving within the battery
- This threshold must be reached in order to fully charge a battery

Effect of Temperature

- Gassing threshold is higher at lower temps, lower at higher temps
- Too much voltage at high temperatures can “boil” and destroy a battery



Digital Linear Chargers

Specifications

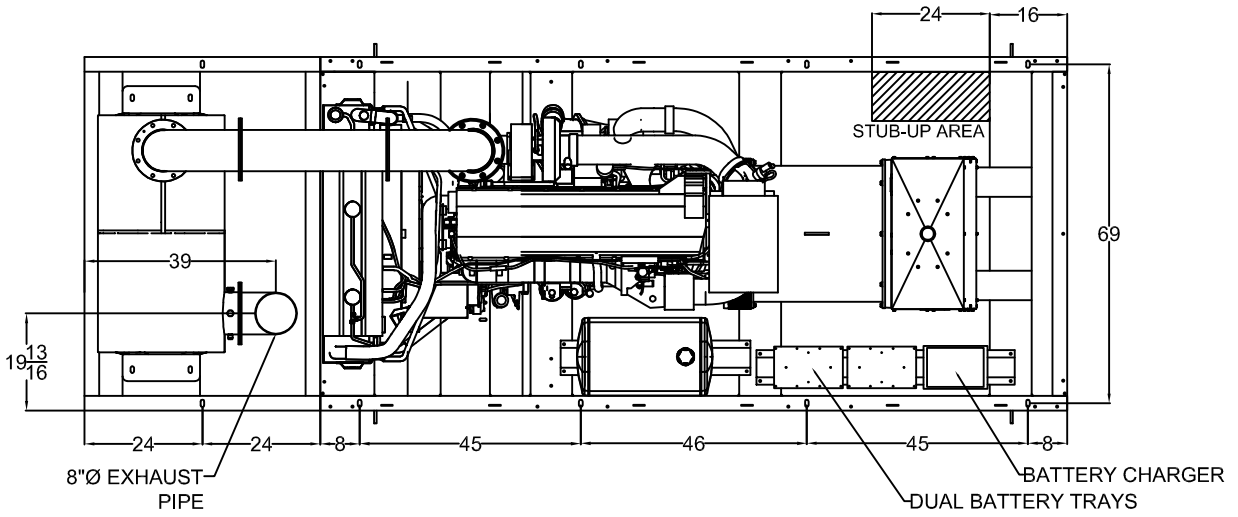
- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant
- UL listed to marine standard 1236
- 3 year warranty
- Replaces all existing current on-board chargers (excluding portables)
- No Price Increase
- Availability: November 2010

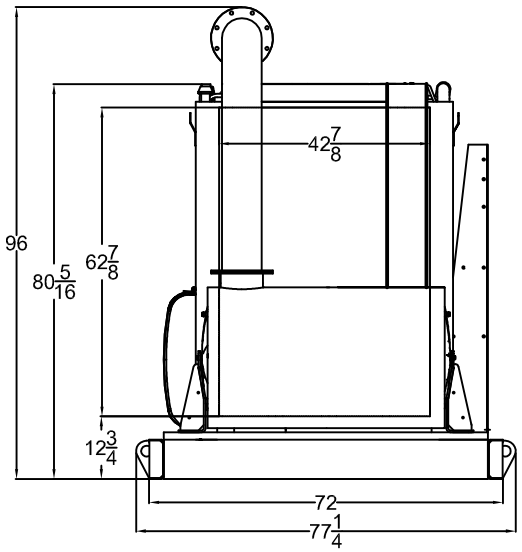


DIGITAL LINEAR ON-BOARD CHARGERS	
PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 amps)
1822305	MK-230D (2 bank x 15 amps)
1823455	MK-345D (3 bank x 15 amps)
1824605	MK-460D (4 bank x 15 amps)

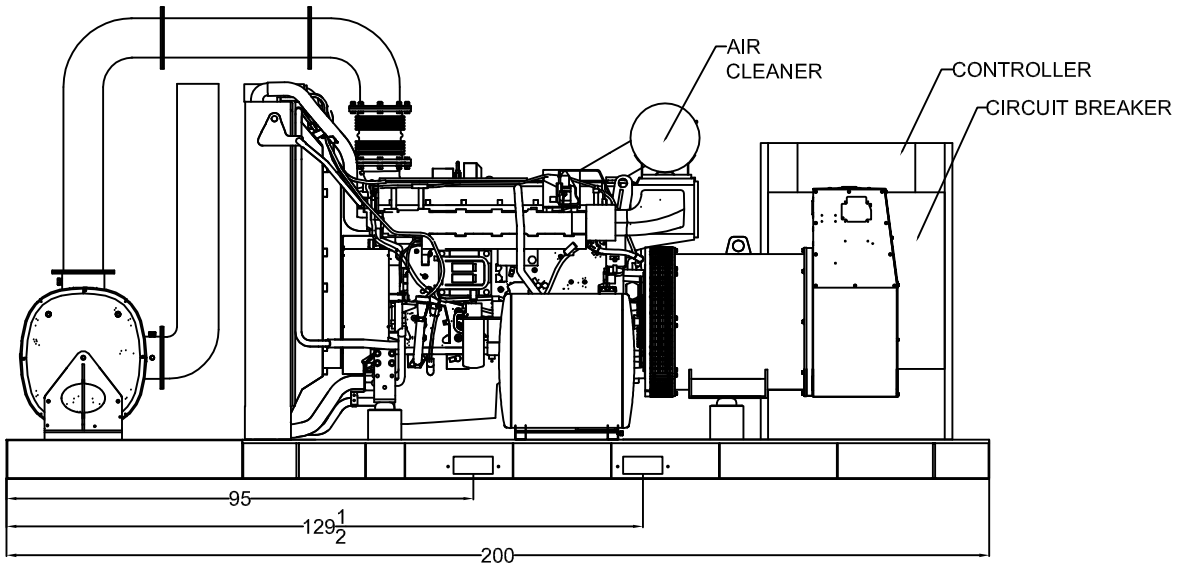
T4D-6000 OPEN DIMENSIONAL OVERVIEW

TOP VIEW





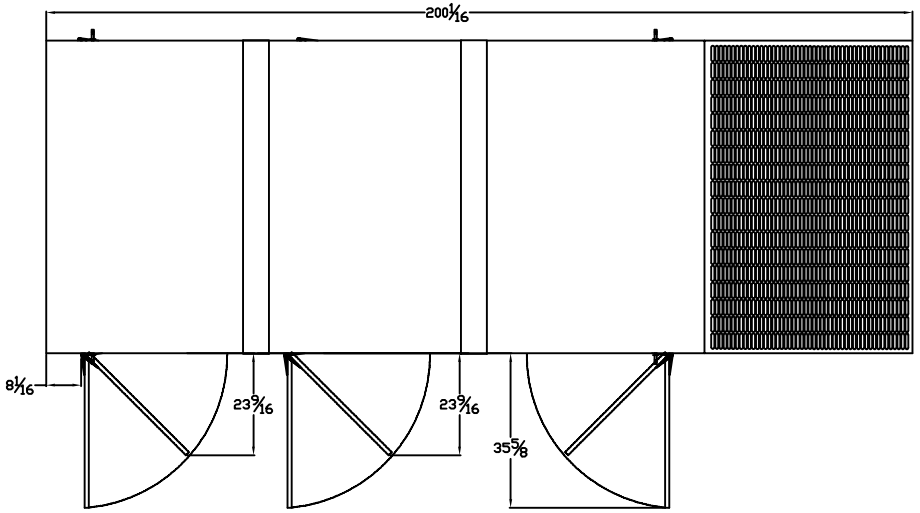
RADIATOR VIEW



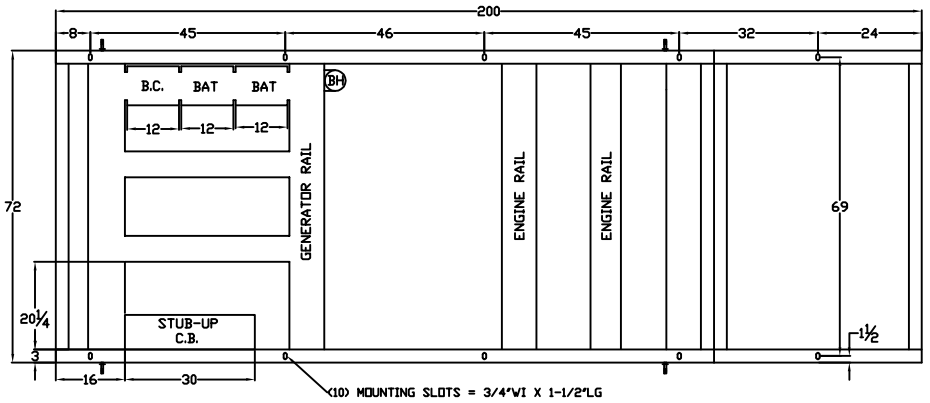
SIDE VIEW

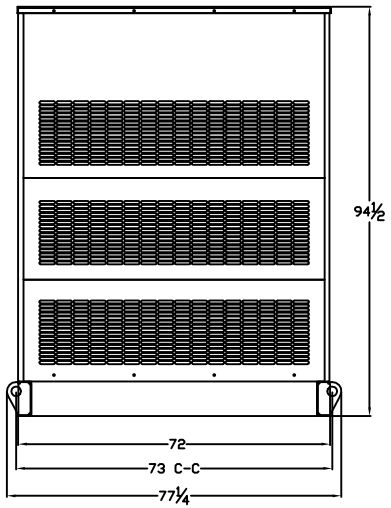
T4D-5500 THRU T4D-6000 LEVEL 2 ENCLOSURE OUTLINE DIMENSIONS
WITH RESIDENTIAL GRADE SILENCER

TOP VIEW
(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)

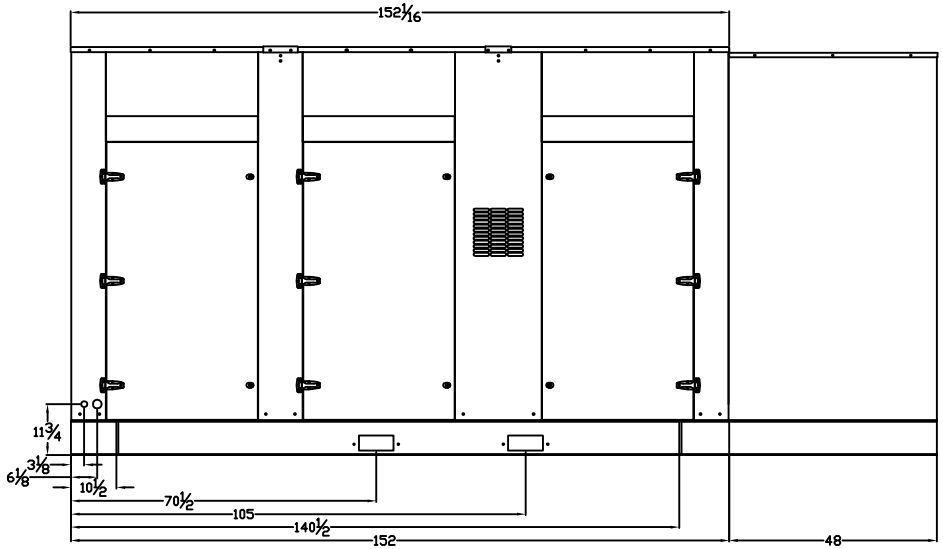


FRAME VIEW

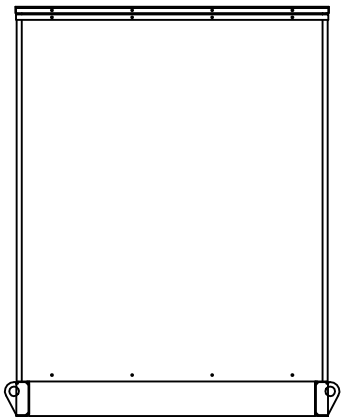




GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW

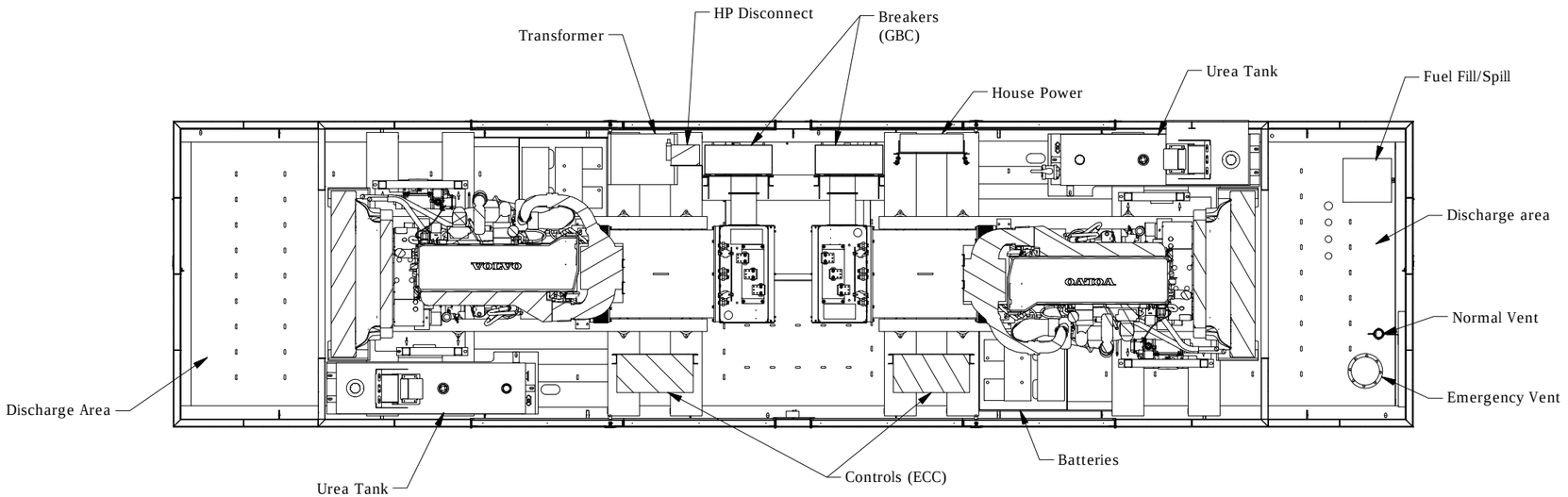
POWERSECURE

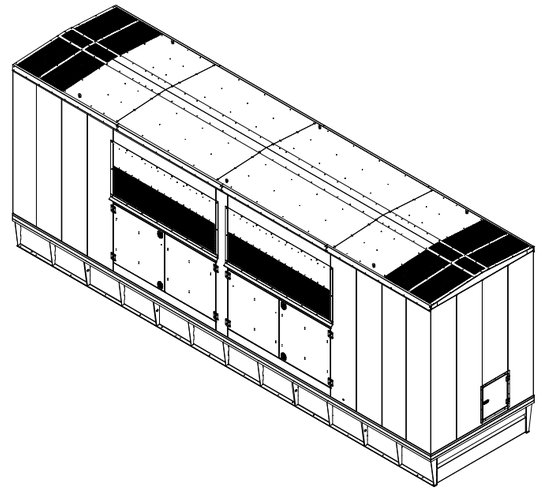
iDG

INTERACTIVE DISTRIBUTED GENERATION

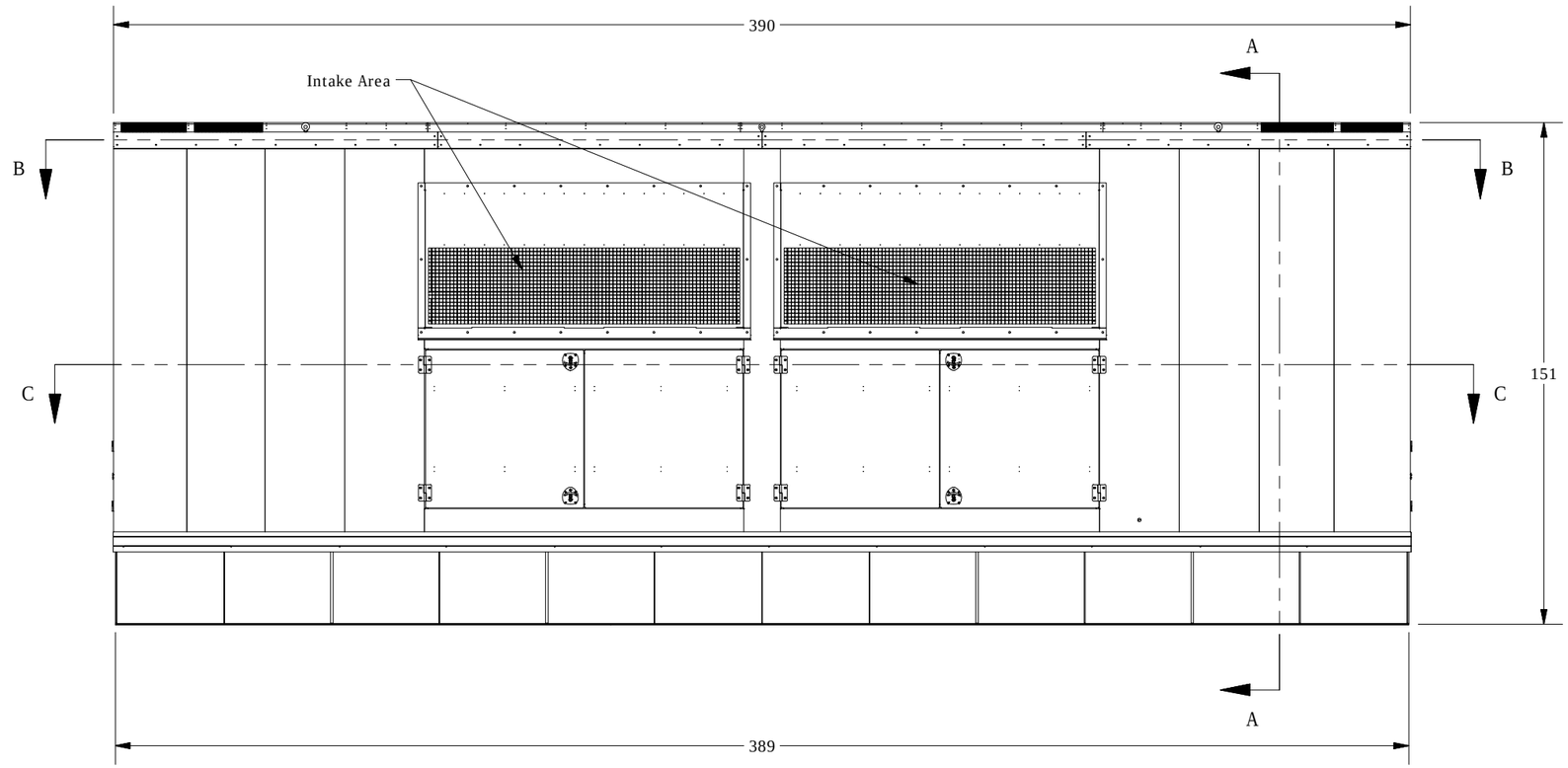
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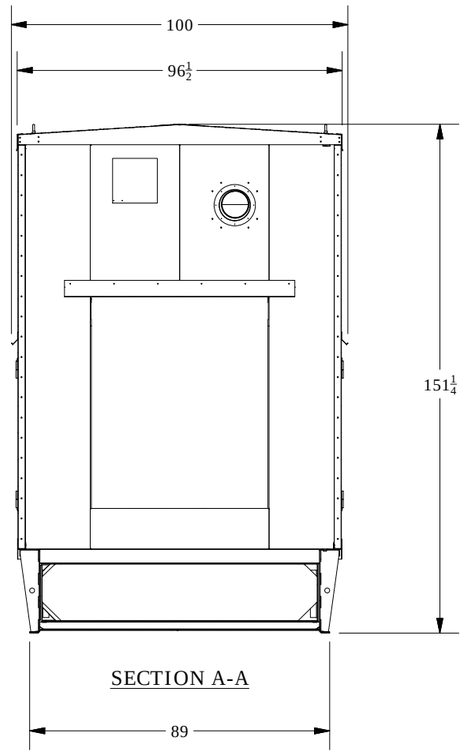
PowerBlock® System





SECTION C-C





SECTION A-A

1250KW SL2				
Item	Description	QTY	Unit W	Extended Weight
1	Gen Set Weight	1	47,300	47,300
2	Fuel Weight	2,000	7.1	14,200
3	DEF Weight	200	9	1,800
				Total: 63,300
				PSI Load: 32.54

Power Secure

REV: | PG: OF

EQUIPMENT DESIGNATION: Mechanical

EQUIPMENT TYPE:

DRAWING TYPE: Generator Package

MANUFACTURING:
1410 Coltrane Mill Rd.
Randleman, NC 27317

HEADQUARTER:
1609 Heritage Commerce Ct.
Wake Forest, NC 27587

DESCRIPTION	DATE	REV.

JOB NAME: 770xx-Walmart Wave 20 T4F Double

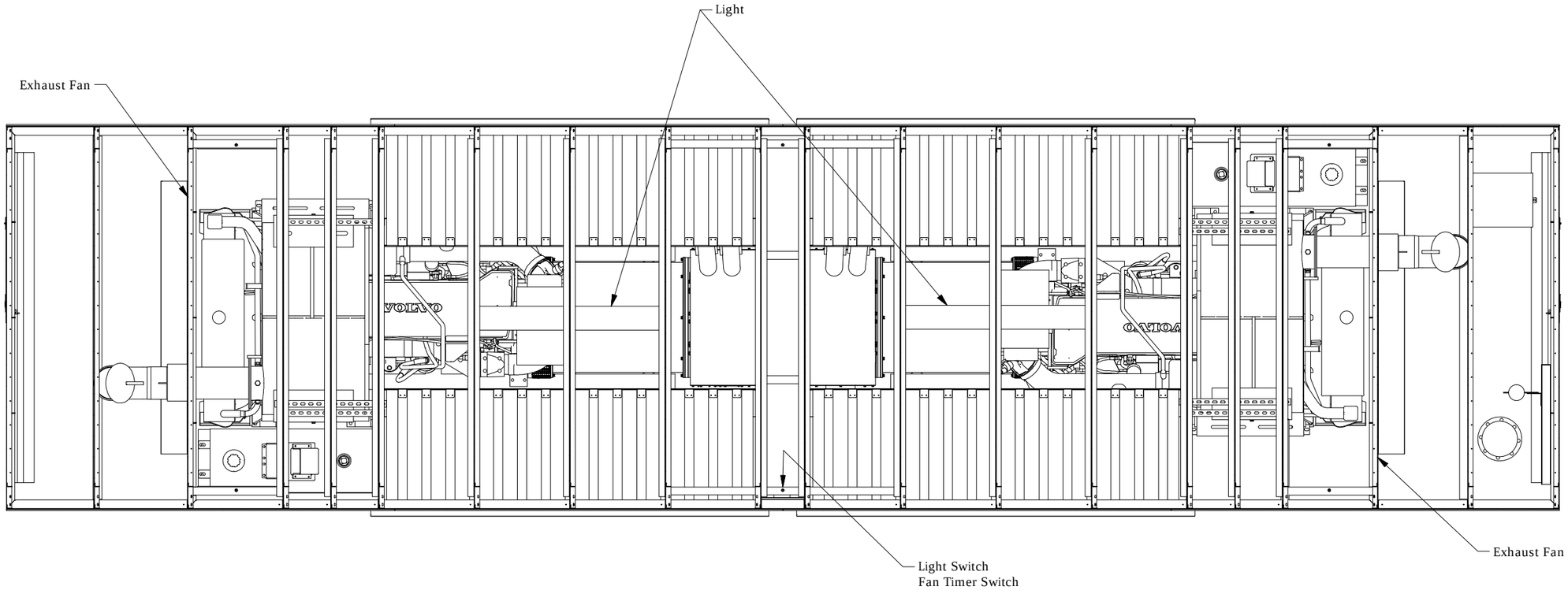
JOB LOCATION:

DRAWN BY: JEP

ENGR:

DATE: 8/30/2017

DRAWING #: 1 of 4



SECTION B-B

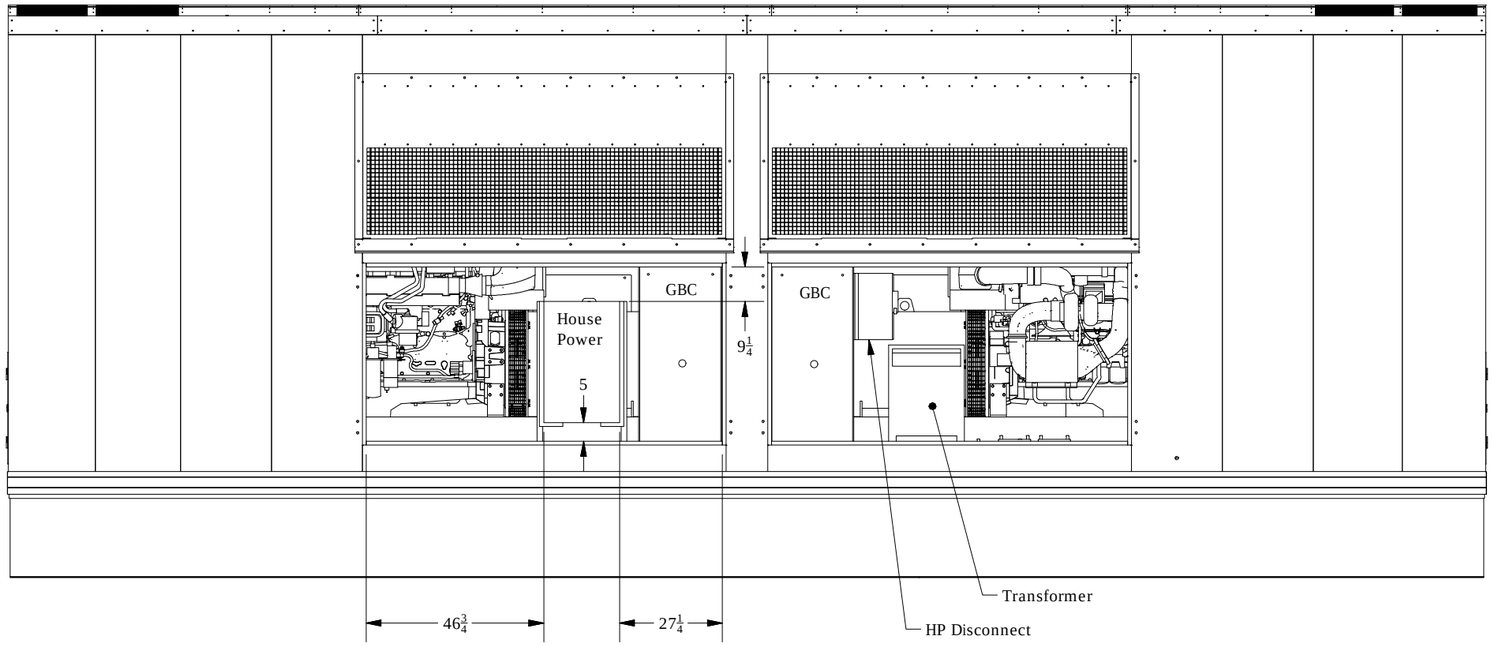
EQUIPMENT DESIGNATION:
EQUIPMENT TYPE:
DRAWING TYPE:
HEADQUARTER:
1609 Heritage Commerce Ct.
Wake Forest, NC 27587
MANUFACTURING:
1410 Coltrane Mill Rd.
Randleman, NC 27317

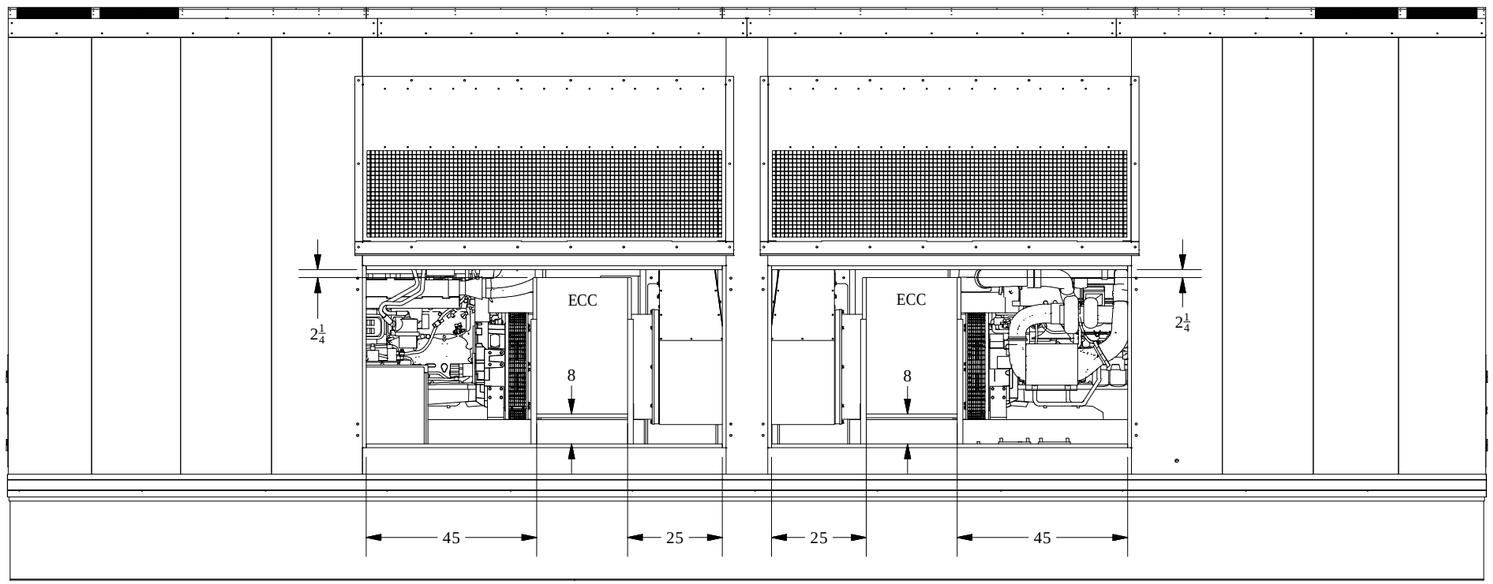
Power Secure

PG: OF REV:

DESCRIPTION	DATE	REV.

JOB NAME: 770xx-Walmart Wave 20 T4F Double
JOB LOCATION:
DRAWN BY: JEP
ENGR:
DATE: 8/30/2017
DRAWING #:





JOB NAME: 770xx-Walmart Wave 20 T4F Double	EQUIPMENT DESIGNATION:
JOB LOCATION:	EQUIPMENT TYPE:
DRAWN BY: JEP	DRAWING TYPE:
ENGR:	HEADQUARTER: 1609 Heritage Commerce Ct. Wake Forest, NC 27587
DATE: 8/30/2017	MANUFACTURING: 1410 Coltrane Mill Rd. Randleman, NC 27317
DRAWING #:	PG: OF

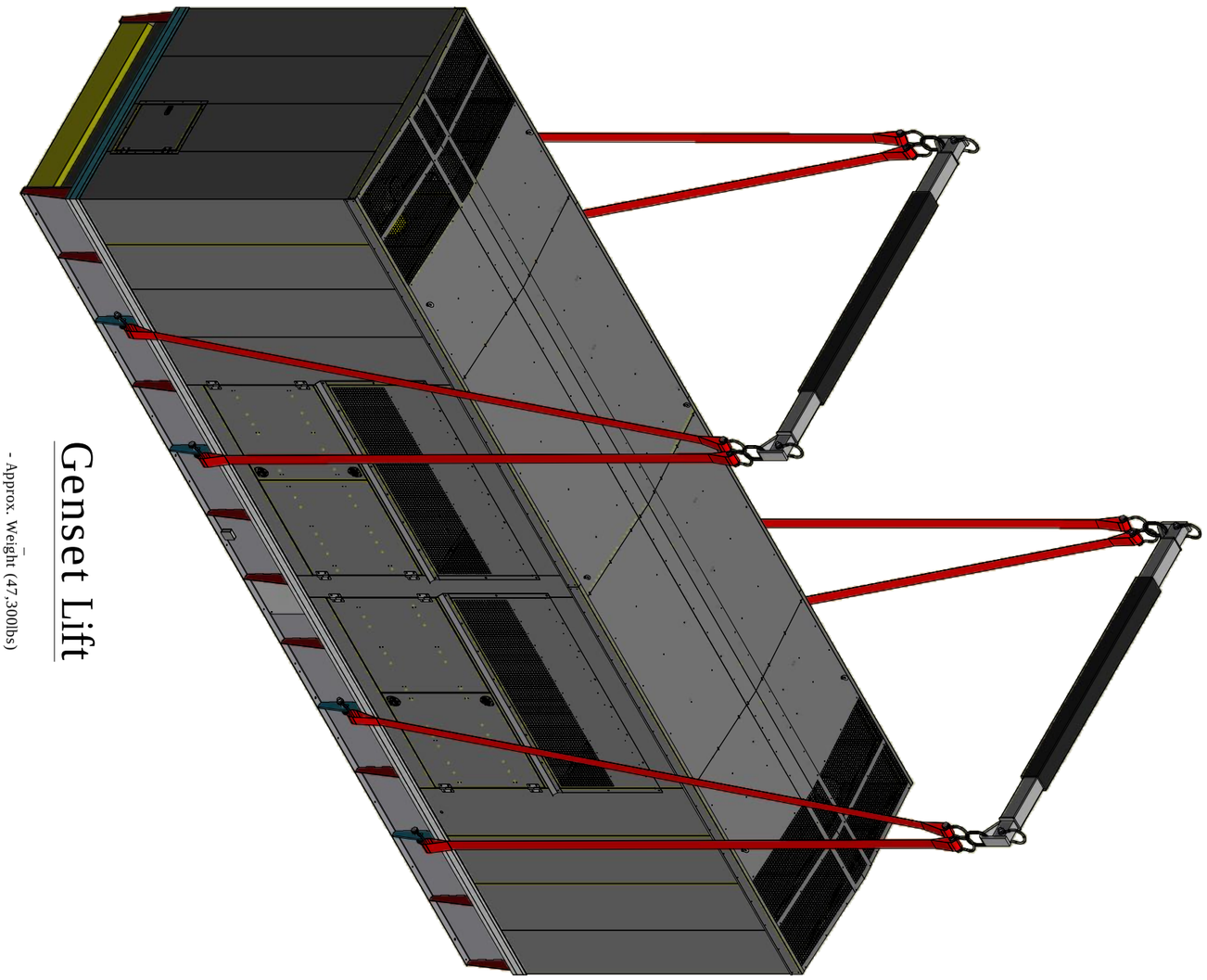
REV.	DATE	DESCRIPTION

Power Secure

REV:

Genset Lift

- Approx. Weight (47,300lbs)



JOB NAME: 770xx-Walmart Wave 20 T4F Double	REV.	DATE	DESCRIPTION	EQUIPMENT DESIGNATION:		
JOB LOCATION:				EQUIPMENT TYPE:		
DRAWN BY: JEP				DRAWING TYPE:		
ENGR:				HEADQUARTER:	MANUFACTURING:	
DATE: 8/30/2017				1609 Heritage Commerce Ct.	1410 Coltrane Mill Rd.	
DRAWING #: 4 of 4				Wake Forest, NC 27587	Randleman, NC 27317	

PG: OF REV:

550

	DESCRIPTION
A	1/2" NPT FUEL SUPPLY
B	1/2" NPT FUEL RETURN
C	SPARE
D	2" NPT MECHANICAL GAUGE
E	2" NPT MUSHROOM VENT (OEM #4025)
F	6" NPT EMERGENCY VENT
G	1/2" NPT BASIN ALARM AND DRAIN (EQ# 682)
H	5 Ga Fuel Fill/Spill

GENERAL NOTES: TANK TO INCORPORATE THE FOLLOWING: (SOME ITEMS MAY BE OPTIONS)

1. OVERSPILL (SPILL CONTAINMENT)
2. OVERFILL - PROTECTION VALVE - OPTIONAL
3. HIGH LEVEL FUEL SWITCH
4. INTERSTITIAL SWITCH
5. LEVEL ALARM.- AS REQUIRED
6. 7 1/2 GALLON SPILL CONTAINMENT (OPTIONAL)

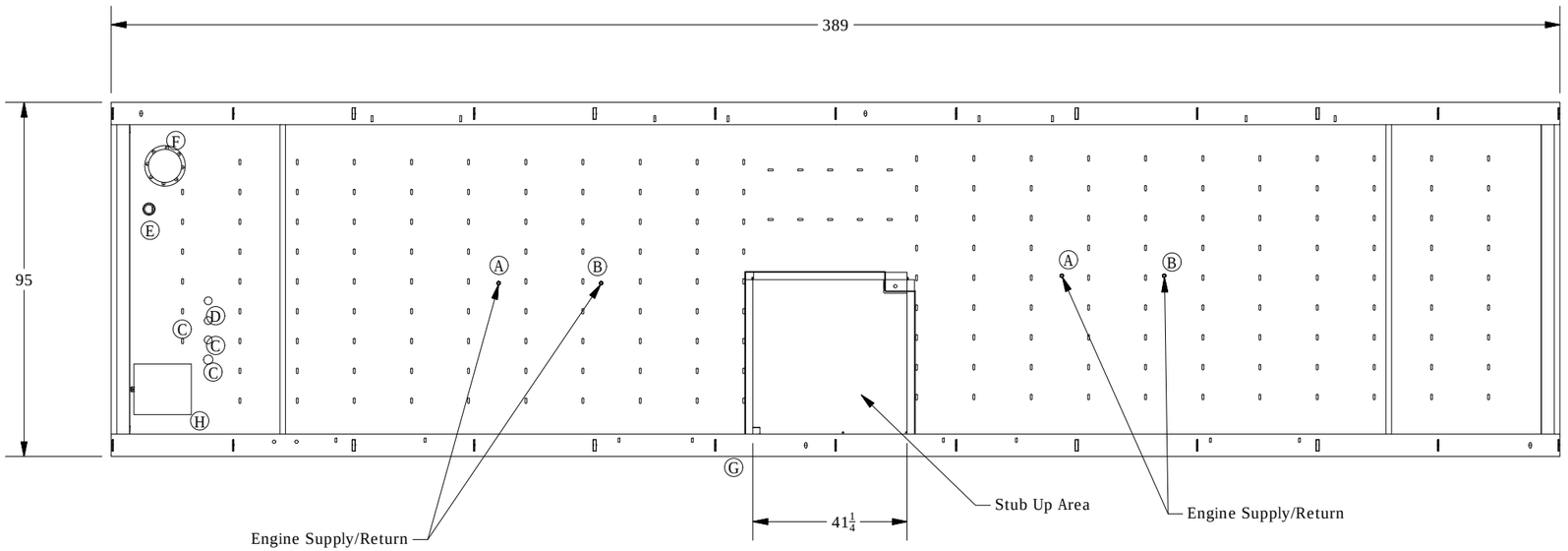
POWERSECURES CLOSED TOP DIKED GENERATOR SUB-BASE DIESEL FUEL TANKS HAVE BEEN DESIGNED WITH AN INNER TANK TO CONTAIN DIESEL FUEL ONLY . THE OUTER STEEL DIKE IS INTENDED TO CONTAIN ANY RUPTURE OR LEAK OF THE INNER TANK. THE DESIGN ALLOWS FOR A STEEL COVER TO PROTECT THE DIKED AREA FROM PRECIPITATION AND OF DEBRIS FROM ENTERING THE DIKED AREA.

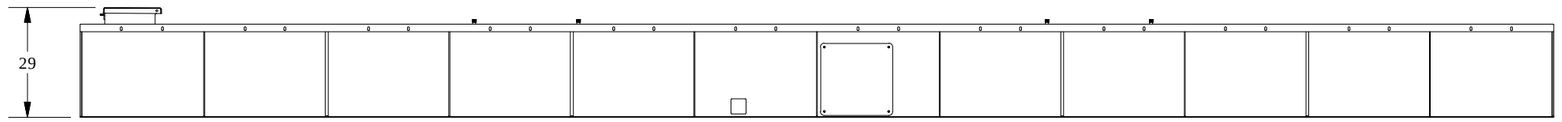
POWERSECURES CLOSED TOP DIKE SUB-BASE FUEL TANKS ARE DESIGNED AND FABRICATED IN ACCORDANCE WITH UNDERWRITERS LABORATORIES UL #142 STANDARDS, FILE # MH 45666 AND ARE INSTALLED IN ACCORDANCE WITH NFPA #30 CODES (NATIONAL FIRE PROTECTION ASSOCIATION) AND ARE FLORDIA DER / DEP CERTIFIED. [#EQ - 661]

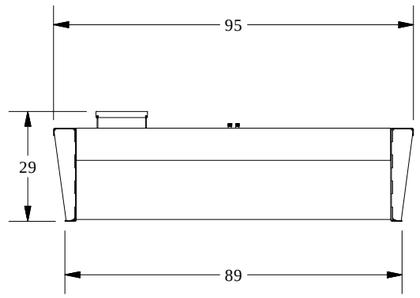
POWER FAB/ POWER SECURES CLOSED TOP DIKED DIESEL FUEL TANKS ARE FABRICATED WITH A MINIMUM STD SPEC.

STANDARD FEATURES:

- UL #142 CLOSED TOP DIKE CONTRUCTION
- INNER TANK - 10GA (.135) STEEL
- OUTER TANK - 3/16 (.188) STEEL
- NORMAL VENT- SIZED FOR SPECIFIC TANK
- INNER FUEL TANK EMERGENCY VENT SIZED FOR SPECIFIC TANK
- OUTER CONTAINMENT AREA VENTED TO ATMOSPHERE BY DESIGN
- STANDARD GRAY POLYURETHANE PAINT TOP COAT







FUEL TANK INFORMATION

Scale: N.T.S.

JOB NAME: POWERSECURE		PowerFab. Randleman, NC PHONE(336) 938-0184	
APPROVED BY:			
DATE		FILE	DWG NO. 2000 GAL - 24 HRS / REV 0
DRAWN BY:	DATE	SCALE N.T.S.	SPEC UL# 142 DOUBLE WALL / UNIT

EQUIPMENT DESIGNATION: Fuel Tank
EQUIPMENT TYPE:
DRAWING TYPE: Mechanical
MANUFACTURING: 1410 Coltrane Mill Rd. Randleman, NC 27317
HEADQUARTER: 1609 Heritage Commerce Ct. Wake Forest, NC 27587

DESCRIPTION | DATE | REV.

JOB NAME: 770xx - Walmart Wave 20 T4F Double
JOB LOCATION:
DRAWN BY: JEP
ENGR:
DATE: 8/30/2017
DRAWING #: 2 OF 5

REV: | PG: OF

TWD1672-1673GE

VOLVO PENTA GENSET ENGINE

615 kW (836 hp) & 685 (932) at 1800 rpm, acc. to ISO 3046

US EPA & CARB Tier 4 Final

A powerful, reliable, and economical generating set diesel engine range built on the proven Volvo Group in-line six concept.



Powerful package
High power density in a compact package with dual stage turbo charging. Excellent load step performance according to ISO 8528-5.

Low cost of ownership & operation
World class fuel efficiency in combination with a proven and reliable engine and exhaust aftertreatment system design. The exhaust aftertreatment system consists of only an SCR, without EGR, DOC or DPF. Minimal components are used and no downtime for regeneration or decreased service intervals. No EGR also results in less heat rejection, leading to excellent power density and improved fuel economy.

Compact & simple installation
SCR technology selected by Volvo Group does not increase the amount of cooling capacity needed. In combination with the compact engine design, installation is easy with minor impact on existing installation layout. Installation guidelines as well as drawings and CAD models are easy to access.

Durability & low noise
Volvo Group´s long experience with SCR systems, in combination with base engine development, reduces risk of downtime. Well-balanced to produce smooth and vibration free operation with low noise.

Low exhaust emission
Efficient injection as well as robust engine design in combination with SCR technology contributes to excellent combustion and low fuel consumption.

Easy service & maintenance
Easily accessible service and maintenance points contribute to the ease of service.

- **Proven and straight-forward design - built on Volvo Group technology**
- **Low cost of ownership and operation**
- **SCR only - no EGR, DOC, DPF or regeneration**
- **High efficient cooling system**
- **Excellent step load performance acc. to ISO 8528-5**
- **Compact, simple installation and easy to service**
- **Available as Genpac or Base engine configuration**

60 Hz/1800 rpm

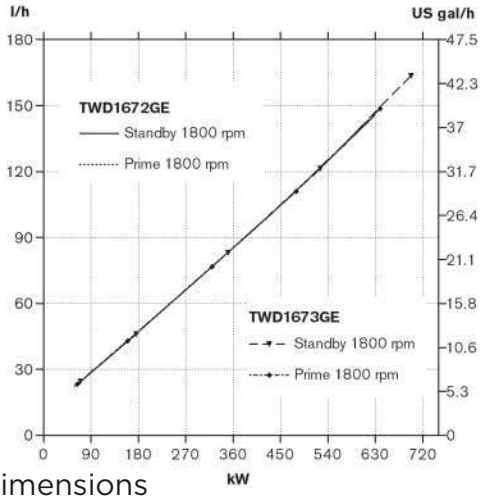
	Prime power			Standby power			Generator eff.
Engine	kWm	kWe	kVA	kWm	kWe	kVA	(%)
TWD1672GE	532	508	635	585	559	698	95,5

TWD1672-1673GE

Technical Data

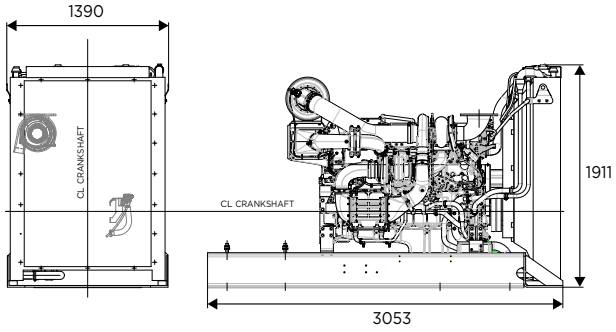
Engine designation	TWD1672-1673GE
Configuration and no. of cylinders	in-line 6
Displacement, l (in³)	16.12 (983.9)
Method of operation	4-stroke
Bore, mm (in.)	144 (5.67)
Stroke, mm (in.)	165 (6.50)
Compression ratio	16.8:1
Wet weight, engine only, kg (lb)	1810 (3390)
Wet weight, Genpac (engine, cooling system, air filtration system and frame kg (lb)	2767(6100)

Performance (with fan, kW (hp))	**1800 rpm**
TWD1672GE	
Prime Power	532 (724)
Standby Power	585 (796)
Fan Power Consumption	30 (41)
TWD1673GE	
Prime Power	595 (809)
Standby Power	655 (891)
Fan Power Consumption	30 (41)



Dimensions

Not for installation. Dimensions in mm.



Technical Description

Engine and Block

- Cast iron cylinder block with optimum distribution of forces without the block being unnessarily heavy.
- Wet, replaceable cylinder liners.
- Tapered connecting rods for increased piston lifetime.
- Crankshaft induction hardened bearing surfaces and fillets with seven bearings for moderate load on main and high-end bearings.
- Case hardened and nitrocarburized transmission gears for heavy duty operation.
- Viscous type crankshaft vibration dampers to withstand single bearing alternator torsional vibrations.
- Replaceable valve guides and valve seats.
- Overhead camshaft and 4 valves per cylinder.

Lubrication System

- Full flow oil cooler.
- Full flow disposable spin-on oil filter, for extra high filtration.
- Lubricating oil level can be measured at start-up.

Fuel System

- Electronic high pressure unit injectors.
- Fuel prefilter with water separator and water-in-fuel indicator/alarm.
- Fine fuel filter with manual feed pump and fuel pressure switch.

Cooling System

- Efficient cooling with accurate coolant control through a water distribution duct in the cylinder block.
- Belt-driven coolant pumps with high degree of efficiency.
- Water-cooled charge air coolers.

Turbo Charger

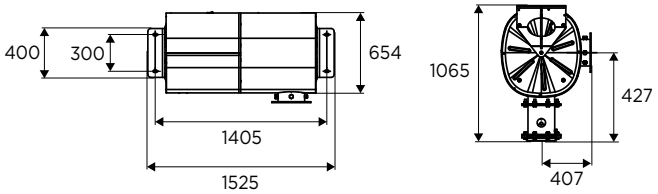
- Efficient and reliable dual stage turbo chargers.
- Intermediate charge air coolers for both turbo chargers.
- Waste gate system for high pressure turbo charger.

Electrical System

- Engine Management System 2.3 (EMS 2.3), an electronically controlled processing system which optimizes engine performance. It also includes advanced facilities for diagnostics and fault tracing.
- The instruments and controls connect to the engine via the CAN SAE J1939 interface. The DCU is a control panel with display, engine control, monitoring, alarm, parameter setting and diagnostic functions. It also presents error codes in clear text. The DCU makes it possible to install and combine several sets of analogue and digital instruments.
- Sensors for oil pressure, oil temp, boost pressure, boost temp, coolant temp, fuel temp, water in fuel, fuel pressure and two speed sensors.

Exhaust Aftertreatment System

- SCR only. No EGR, DOC, DPF or regeneration. Wide range of installation options available.
- AdBlue/DEF tank including AdBlue/DEF Quality Level Temperature Sensor.



Rating guidelines

PRIME POWER rating corresponds to ISO Standard Power for continuous operation. It is applicable for supplying electrical power at variable load for an unlimited number of hours instead of commercially purchased power. A 10% overload capability for Governing purpose is available for this rating. STANDBY POWER rating corresponds to ISO Standard Fuel Stop Power. It is applicable for supplying standby electrical power at variable load in areas with well established electrical networks in the event of normal utility power failure. No overload capability is available for this rating.
1 kW = 1 hp x 1.36
1 hp = 1 kW x 0.7355

Power standards

The engine performance corresponds to ISO 3046, BS 5514 and DIN 6271. The technical data applies to an engine without cooling fan and operating on a fuel with calorific value of 18360 BTU/lb (42.7 MJ/kg) and a density of 7.01 lb/US gal (0.84 kg/liter), also where this involves a deviation from the standards. Power output guaranteed within 0 to +2% att rated ambient conditions at delivery. Ratings are based on ISO 8528. Engine speed governing in accordance with ISO 3046/IV, class A1 and ISO 8528-5 class G3

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VOLVO PENTA

TWD1673GE

Document No	Issue Index
22412771	02

Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta Application of Certification.

Requirements marked with ⚠ are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta Application of Certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in non-road equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalities as described in the Clean Air Act.

General

In-line four stroke, turbocharged diesel engine with direct injection. Rotation direction is counter-clockwise viewed towards flywheel.

Number of cylinders			6
Displacement, total		litre in^3	16.12 983.9
Firing order			1-5-3-6-2-4
Bore		mm in	144 5.67
Stroke		mm in	165 6.50
Compression ratio			16.8:1
Wet weight (Not including After Treatment System)	Engine only	kg lb	1810 3990
	Engine including Cooling System and Air Filtration System	kg lb	2217 4888
	Frame	kg lb	550 1213
	Compensator and Mixer Pipe	kg lb	25 55
	EATS Muffler	kg lb	188 414

Performance			**1500 rpm**	**1800 rpm**
Prime Power	without fan	kW hp	NA NA	625 850
	with fan	kW hp	NA NA	595 809
Standby Power	without fan	kW hp	NA NA	685 932
	with fan	kW hp	NA NA	655 891
Torque at:	Prime Power	Nm lbft	NA NA	3316 2445
	Standby Power	Nm lbft	NA NA	3634 2680
Mean Piston Speed		m/s ft/sec	NA NA	9.9 32.6
Effective Mean Pressure at:	Prime Power	MPa psi	NA NA	2.6 375
Effective Mean Pressure at:	Standby Power	MPa psi	NA NA	2.8 411
Maximum Combustion Pressure at:	Prime Power	MPa psi	NA NA	22 3191
Maximum Combustion Pressure at:	Standby Power	MPa psi	NA NA	22.5 3263
Total Mass Moment of Inertia, J (mR^2) with Flywheel		kgm^2 $lbft^2$	2.50 59.3	
Total Mass Moment of Inertia, J (mR^2) without Flywheel		kgm^2 $lbft^2$	1.92 45.6	
Friction Power		kW hp	NA NA	51 69.4

Derating due to altitude - see Technical Diagrams

Engine Noise Emission

Test Standards: ISO 3744-1981 (E) sound power

Tolerance ± 0.75 dB(A)

			1500 rpm	**1800 rpm**
Measured Sound Power Lw	No load	dB(A)	NA	118.1
	Prime Power	dB(A)	NA	119.1
	Standby Power	dB(A)	NA	118.9
Calculated sound pressure Lp at 1 m	No load	dB(A)	NA	101.1
	Prime Power	dB(A)	NA	102.1
	Standby Power	dB(A)	NA	101.9

Test Conditions for Load Acceptance Data

Warm Engine	**Generator**			**Model**		**Type of AVR**	
	Stamford			HCM534F1		MX341	
AVR Settings	UFRO (Hz):		57	DIP (%)*:	50	DWELL (%)*:	N/A
	Stability (%)*:	According to Stamford instructions		Voltage (V):	400	Load factor:	1.0

Applies to Stamford nomenclature,
(%)* : % of max potentiometer setting range
Load acceptance performance can vary due to actual alternator inertia, voltage regulator, type of load and local ambient conditions.

Abbreviation:	Full name:	Descriptions
AVR	Automatic Voltage Regulator	Generator performance and safety control unit
UFRO	Under Frequency Roll Off	Overheating protection at under-frequency
DIP		Controls the slope of voltage drop when the UFRO is active
DWELL		Controls the slope of voltage recovery when the UFRO is active.

Single-Step Load Performance @ 1800 rpm - PRIME (Resistive Load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	2.6	1.5	0.5	0.0	20-100	8.8	2.9	17.6	1.6
0-40	4.8	2.1	5.3	1.2	40-100	5.9	2.5	9.8	1.5
0-52	7 (G3)	2.3	10.6	1.2	58-100	4.5	2.2	4.0	1.1
0-60	7.4	2.3	11.6	1.2	60-100	4.5	2.1	3.5	1.1
0-68	10 (G2)	2.7	17.1	1.2	71-100	3.5	1.8	2.0	0.8
0-80	12.3	3.1	22.4	1.4	80-100	2.6	1.4	1.5	0.4
0-100	17.4	3.4	31.7	2.1					
100-0	5.6	1.9	8.3	1.7					

Single-Step Load Performance @ 1800 rpm - STANDBY (Resistive Load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	2.9	1.5	0.8	0.6	20-100	10.8	3.2	21.6	1.7
0-40	5.1	2.1	5.8	1.1	40-100	6.9	2.8	12.3	1.6
0-54	7 (G3)	2.3	10.8	1.2	54-100	5.3	2.4	6.0	1.4
0-60	8.4	2.7	14.6	1.2	60-100	4.7	2.2	4.0	1.4
0-67	10 (G2)	2.9	16.8	1.2	67-100	4.3	2.1	3.3	1.2
0-80	13.3	3.2	24.1	1.7	80-100	3.1	1.6	2.3	0.8
0-100	19.8	3.8	35.4	1.8					
100-0	4.3	1.0	9.8	2.4					

Cold Start Performance

				1500 rpm	1800 rpm
Time from start to stay within 0.5% of no load speed at ambient temperature:	°C	20	s	NA	4.3
		5	s	NA	5.3
		-15 *	s	NA	5.3
		-30 **	s	NA	5.7
		Min start temp*	°C	-31.0	

* With manifold heater 4 kW engaged, lubrication oil 15W/40 and block heater.
** With manifold heater 4 kW engaged, lubrication oil 5W/30 and block heater, Fuel MK-1.

Block Heater Make:	Volvo Part No:	Power kW	Engaged Hours	Cooling Water Temp - Engine Block
Calix	11454340 P01	1.5 kW	10h ambient temp-30 C	-2°C 28°F

Lubrication System

				1500 rpm	1800 rpm
Lubricating oil consumption:	Prime Power		litre/h US gal/h	NA	0,10 0,026
	Standby Power		litre/h US gal/h	NA	0,11 0,029
Oil system capacity including filters:			litre US gal	48 12.7	
Oil sump capacity:		max	litre US gal	42 11.1	
		min	litre US gal	32 8.5	
Oil change intervals/specifications:	VDS-3*		h	500	
Engine angularity limits:		front up	°	30	
		front down	°	30	
		side tilt	°	30	
Oil pressure at rated speed:			kPa psi	NA NA	399 58
Lubrication oil temperature in oil sump:		max	°C °F	130 266	
Oil filter micron size:			µ	40	

* See also general section in the sales guide

Fuel System			1500 rpm	1800 rpm
Prime Power	25%	g/kWh	NA	227
Specific **fuel** consumption at:		lb/hph	NA	0.368
	50%	g/kWh	NA	202
		lb/hph	NA	0.327
	75%	g/kWh	NA	195
		lb/hph	NA	0.316
	100%	g/kWh	NA	195
		lb/hph	NA	0.316
% adBlue consumption at:	25%	%	NA	6.4
(Compare to fuel consumption by volume)	50%	%	NA	6.7
	75%	%	NA	7.2
	100%	%	NA	6.4

Standby Power	25%	g/kWh	NA	223
Specific **fuel** consumption at:		lb/hph	NA	0.361
	50%	g/kWh	NA	201
		lb/hph	NA	0.326
	75%	g/kWh	NA	195
		lb/hph	NA	0.316
	100%	g/kWh	NA	197
		lb/hph	NA	0.319
% adBlue consumption at:	25%	%	NA	6.6
(Compare to fuel consumption by volume)	50%	%	NA	6.7
	75%	%	NA	7.2
	100%	%	NA	6.1

Fuel system		1500 rpm	1800 rpm
See front page for important information ⚠ Fuel to conform to:	ASTM D975 (2D)		
System supply flow at:	litre/h	NA	210.0
	US gal/h	NA	55.5
Fuel supply line - Maximum Restriction:	kPa	NA	30.0
(Measured at fuel inlet connection)	psi	NA	4.4
Maximum Pressure with engine stopped:	kPa	NA	0.0
	psi	NA	0.0
System return flow:	litre/h	NA	25.0
	US gal/h	NA	6.6
Fuel return line - Maximum Restriction:	kPa	NA	20.0
(Measured at fuel return connection)	psi	NA	2.9
Maximum allowable inlet fuel temperature:	°C	NA	60
(Measured at fuel inlet connection)	°F	NA	140
Prefilter/Water Separator micron size:	µ	10	
Fuel Filter micron size:	µ	5	
Governor type/make, standard:	Volvo/EMS 2.3		
Injection Pump type/make:	Unit injector hybrid		

Intake and Exhaust System			1500 rpm	1800 rpm
Air consumption at:	Prime Power	m^3/min	NA	48.1
(+25°C and 100kPa)		cfm	NA	1699
	Standby Power	m^3/min	NA	51.1
		cfm	NA	1805
See front page for important information ⚠ Maximum allowed air intake restriction including piping:		kPa	NA	5
		psi	NA	0.7
Air filter restriction of clean Volvo Penta filter:		kPa	NA	1.4
		psi	NA	0.2
Heat rejection to exhaust at:	Prime Power	kW	NA	458
		BTU/min	NA	26072
	Standby Power	kW	NA	521
		BTU/min	NA	29623
Exhaust gas temperature after turbine at:	Prime Power	°C	NA	455
		°F	NA	851
	Standby Power	°C	NA	484
		°F	NA	903
See front page for important information ⚠ Maximum allowable back-pressure in exhaust line (after turbine):	Prime Power	kPa	NA	19
		psi	NA	2.7
	Standby Power	kPa	NA	20
Pipe dimension Ø: mm		psi	NA	2.9
See front page for important information ⚠ Maximum allowable temperature drop between turbine and SCR muffler inlet:	Prime Power	Δ°C	NA	10
		Δ°F	NA	18
	Standby Power	Δ°C	NA	10
		Δ°F	NA	18
SCR muffler pressure drop (at exhaust gas flow and exhaust temperature given):	Prime Power	kPa	NA	9
		psi	NA	1.3
	Standby Power	kPa	NA	10
		psi	NA	1.5
Exhaust gas flow at (temperature & pressure after turbine at corresponding power setting):	Prime Power	m^3/min	NA	126.6
		cfm	NA	4471
	Standby Power	m^3/min	NA	137.8
		cfm	NA	4866

Cooling System				1500 rpm	1800 rpm
Heat rejection radiation from engine at:		Prime Power	kW	NA	26
			BTU/min	NA	1479
		Standby Power	kW	NA	29
			BTU/min	NA	1649
Coolant:			Volvo Penta coolant "ready mix or Volvo Penta coolant mixed with fresh water 40/60		
Radiator cooling system type:				Closed circuit	
Standard radiator core area:			m^2	NA	1.68
			$foot^2$	NA	18.08
Fan diameter:			mm	NA	965
			in	NA	37.99
Fan power consumption:			kW	NA	30
			hp	NA	41
Fan drive ratio:					1.04:1
Coolant capacity:	Engine Only		litre	NA	33
			US gal	NA	8.72
	CACs (Charge Air Coolers)		litre	NA	10
			US gal	NA	2.64
	Coolant radiators including piping, Engine circuit		litre	NA	48
			US gal	NA	12.68
	Coolant radiators including piping, CAC circuit		litre	NA	48
			US gal	NA	12.68
	Expansion Tank, Engine circuit		litre	NA	20
			US gal	NA	5.28
	Expansion Tank, CAC circuit		litre	NA	7
			US gal	NA	1.85
Coolant pump:			drive/ratio	Belt / 1.85:1	
Coolant pump, CAC circuit:			drive/ratio	Belt / 2.29:1	
Thermostat, Engine circuit:	Start to open		°C	NA	82
			°F	NA	180
	Fully open		°C	NA	92
			°F	NA	198
Thermostat, CAC circuit:	Start to open		°C	NA	40
			°F	NA	104
	Fully open		°C	NA	52
			°F	NA	126
Maximum static pressure head (expansion tank height + pressure cap setting):			kPa	NA	100
			psi	NA	14.5
Minimum static pressure head (expansion tank height + pressure cap setting):			kPa	NA	70
			psi	NA	10.2
Standard pressure cap setting:			kPa	NA	75
			psi	NA	10.9
Maximum top tank temperature:			°C	NA	107
			°F	NA	225
Charge air pressure (after charge air coolers):			kPa	NA	360
			psi	NA	52.2
See front page for important information Maximum allowed Charge Air outlet temperature at air inlet temperature 25°C: ⚠	Prime Power		°C	NA	50
			°F	NA	122
	Standby Power		°C	NA	50
			°F	NA	122

OEM Cooling System Design:

- Move of Standard Radiators			**1500 rpm**	**1800 rpm**
Maximum additional coolant, Engine circuit with standard Expansion Tank:		litre	NA	15
		US gal	NA	3.96
Maximum additional coolant, CAC circuit with standard Expansion Tank:		litre	NA	5
		US gal	NA	1.32
Maximum distance in vertical direction with standard pressure cap (75 kPa):		m	NA	2.5
		ft	NA	8.20
Maximum additional pressure drop due to move:		KPa	NA	10
		psi	NA	1.5
- Replacement of Standard Radiators				
Heat rejection to coolant **engine radiator** at:	Prime Power	kW	NA	223
		BTU/min	NA	12,682
	Standby Power	kW	NA	245
		BTU/min	NA	13,933
Heat rejection to coolant **CAC radiator** at:	Prime Power	kW	NA	208
		BTU/min	NA	11,829
	Standby Power	kW	NA	216
		BTU/min	NA	12,284
Minimum coolant flow **engine radiator** (at fully open thermostat):		litre/s	NA	6
		US gal/s	NA	1.59
Minimum coolant flow **CAC radiator** (at fully open thermostat):		litre/s	NA	2.5
		US gal/s	NA	0.66
Maximum coolant pressure drop over **engine radiator** including piping (at coolant flow above):		kPa	NA	70
		psi	NA	10.2
Coolant pressure drop over complete engine circuit cooling system (at coolant flow above):		kPa	NA	160
		psi	NA	23.2
Coolant pressure drop over complete CAC circuit cooling system (at coolant flow above):		kPa	NA	135
		psi	NA	19.6
Nominal coolant pressure before engine circuit coolant pump:		kPa	NA	30
		psi	NA	4.4
Nominal coolant pressure before CAC circuit coolant pump:		kPa	NA	30
		psi	NA	4.4

Cooling Performance

Standard fan: Fan ratio: 1:1.04 Fan type: FIX

Cooling air flow and external restriction at different radiator air temperatures based on 107°C TTT and 40% antifreeze.
Valid at 1 atm. (radiator and cooling fan, see optional equipment)

Engine speed rpm	Air on temp °C	PRIME POWER		STANDBY POWER	
		Air flow m^3/s	External restriction Pa	Air flow m^3/s	External restriction Pa
1800	63	15.2	0		
	62	14.5	100	15.2	0
	61	14.1	200		
	60	13.6	300		
	59			14.5	100
	58			13.9	200
	57			13.6	300

Note: External restrictions are calculated for values >0 Pa

Engine Management System

Functionality	Alternatives	Default setting
Governor mode	Isochronous	Isochronous
Governor droop	N/A	N/A
Governor response	Adjustable PID-constants (VODIA)	
Dual speed	Single speed 1800 rpm, 60Hz	1800.0
Idle speed	600-1200 rpm	900.0
Fine speed adjustment	+- 90 rpm	0.0
Preheating function	On/Off	Off

Engine Sensor & Switch Settings

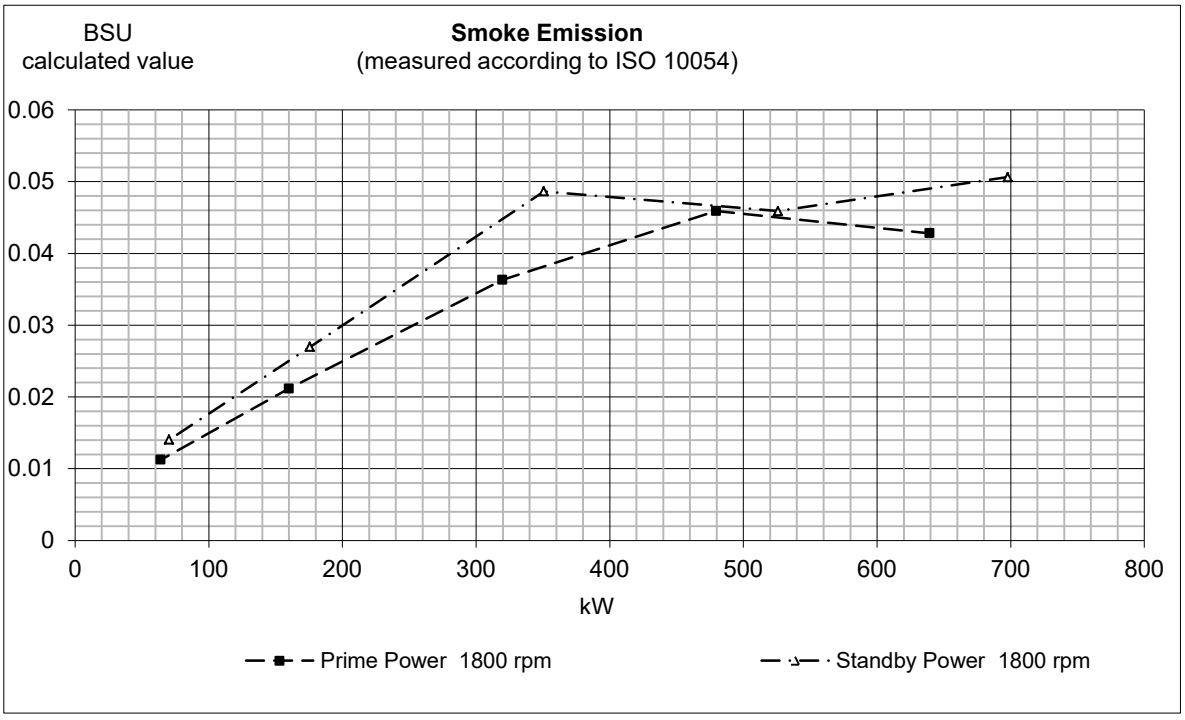
			Alarm level		Engine protection	
Parameter		Unit	Setting range	Default setting	Level	Action. Default/Alternative
Oil temperature		°C	120 - 130	125	Setting +2.5	Shutdown after 10s
Oil pressure	Low idle 900 rpm	kPa	NA	170	145	Shutdown
	1800 rpm	kPa	NA	300	275	Shutdown
Oil level			NA	Min level		
DEF dosing injector failure			NA	On	Low level	Shutdown after 10s
Coolant temperature		°C	95 - 101	103	Setting +4	Shutdown after 10s
Coolant level			See cooling system	On	Low level	Shutdown after 10s
Fuel feed pressure	Low idle	kPa	NA	Min level		
	>1400 rpm	kPa	NA	Min level		
Water in fuel			NA	Max level		
Crank case pressure		kPa	NA	Rapid increase	Rapid increase	Shutdown
Air filter pressure drop		kPa	NA	5		
Altitude, above sea:		m				Automatic derating, see section Smoke, Fuel & Derating
Charge air temperature		°C	NA	80	82.5	Shutdown after 10s
Charge air pressure		kPa	NA	25 above demand	35 above demand	Shutdown after 1s
Engine speed		rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	Shutdown
Exhaust temperature (before SCR volume)		°C	NA	530	550.0	Shutdown after 10s

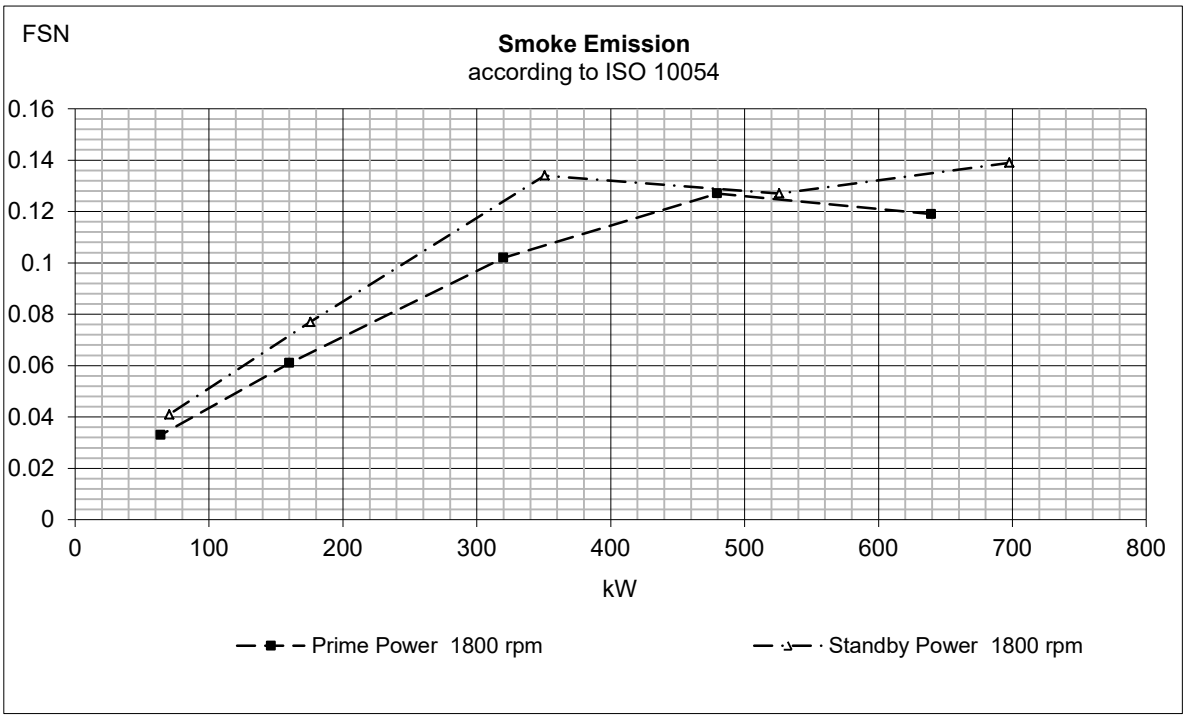
Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy

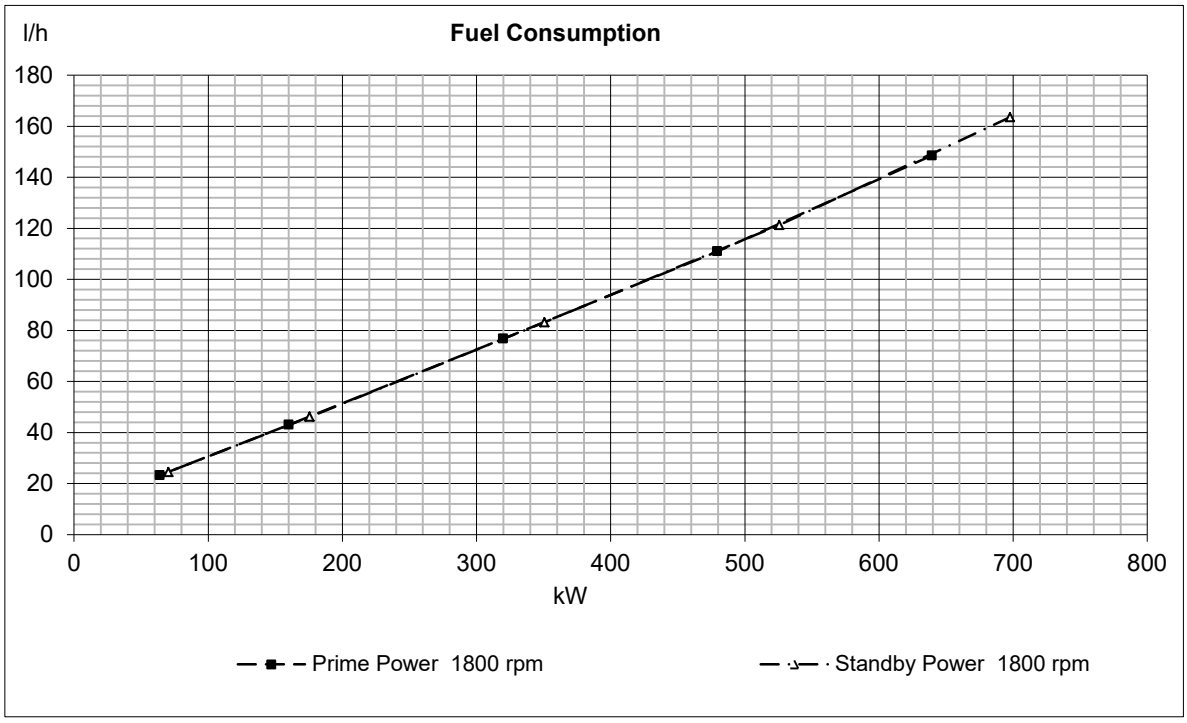
Electrical System

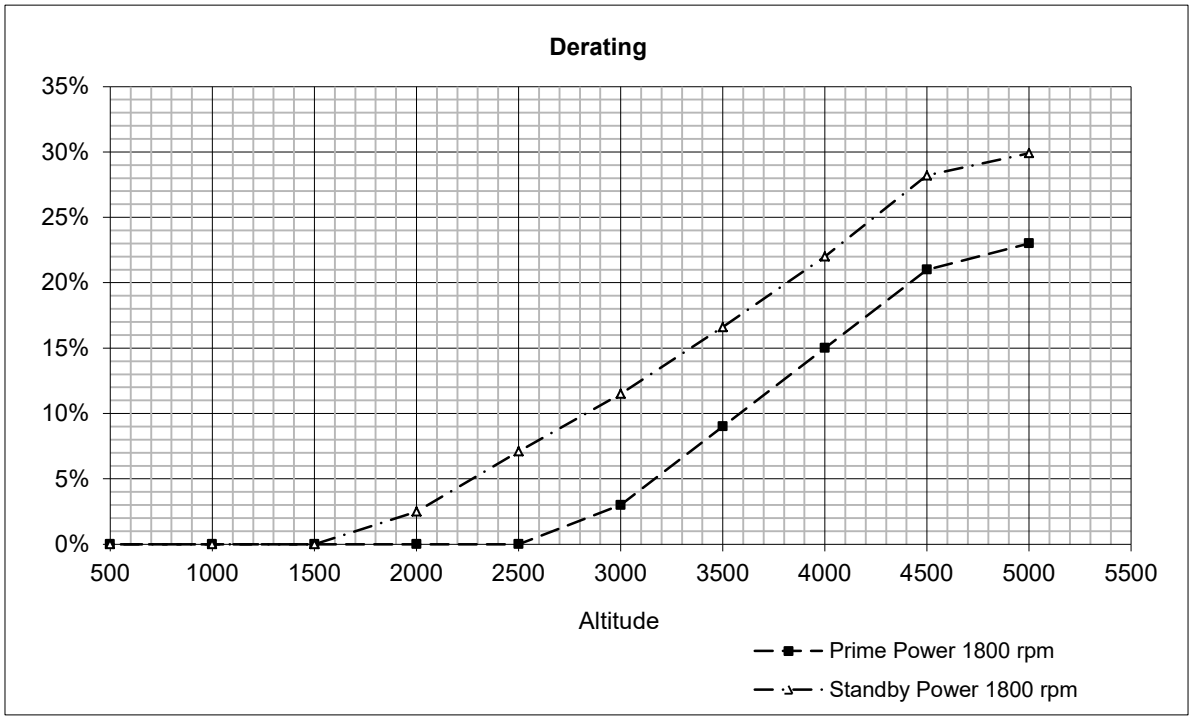
Voltage and Type		24V / insulated from earth	
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		3.94 : 1
Starter Motor:		make	Mitsubishi Electric
		type	24V7.0KW12/3.175F
		kW	7.0
Number of teeth:	flywheel		153
	starter motor		12
Maximum wiring resistance main circuit:		mΩ	
Cranking current at +20°C:		A	300
Crank engine speed at 20°C:		rpm	155
Starter motor battery capacity:	Maximum	Ah/A	2x225
	Maximum at +5°C	Ah/A	
Inlet manifold heater (at 20 V):		kW	4.0
Power relay for the manifold heater:		A	1

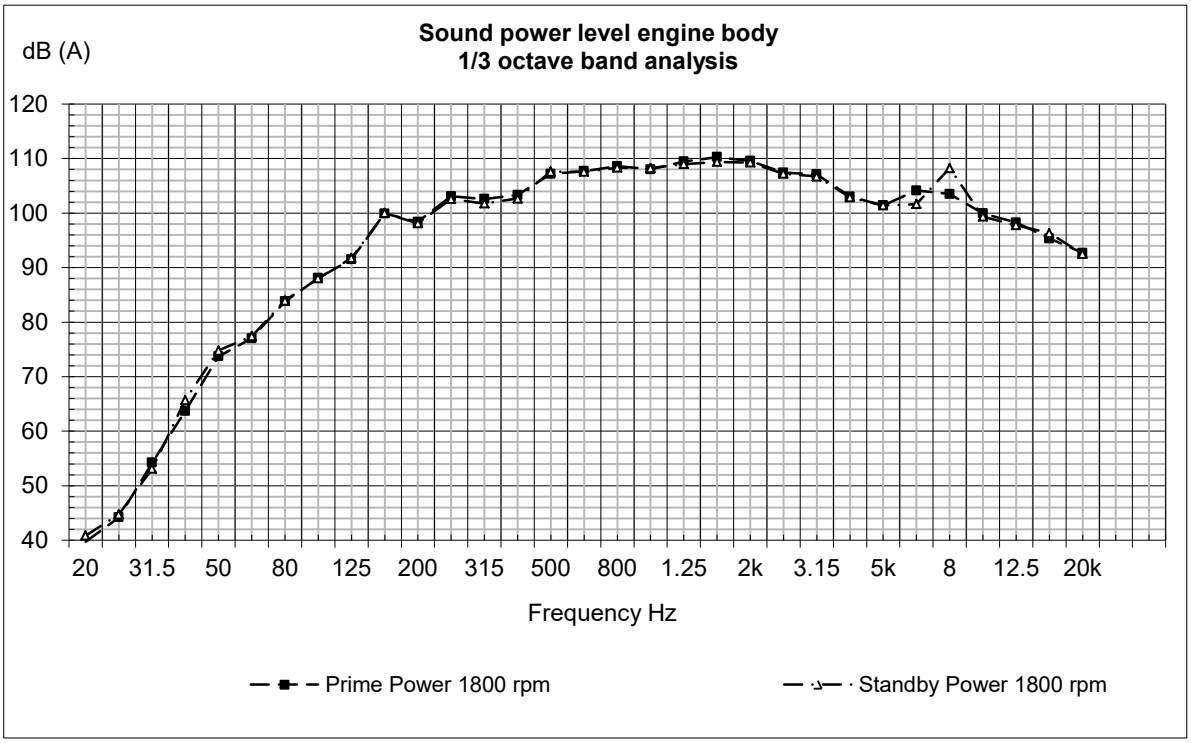
Power Take-Off			**1500 rpm**	**1800 rpm**
Front end in-line with crank shaft - Maximum:		Nm	NA	NA
		lbft	NA	NA
Front end belt pulley load. Direction of load viewed from flywheel side:	Maximum left	kW	NA	NA
		hp	NA	NA
	Maximum down	kW	NA	NA
		hp	NA	NA
	Maximum right	kW	NA	NA
		hp	NA	NA
Timing gear at compressor PTO Maximum:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side:		0.91:1/clockwise		
Timing gear at servo pump PTO Maximum:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side:		1.58:1/clockwise		
Timing gear at hydraulic pump PTO Maximum:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side:				
Maximum allowed bending moment in flywheel housing:		Nm	15,000	
		lbft	11,063	
Maximum rear main bearing load:		N	NA	NA
		lbf	NA	NA

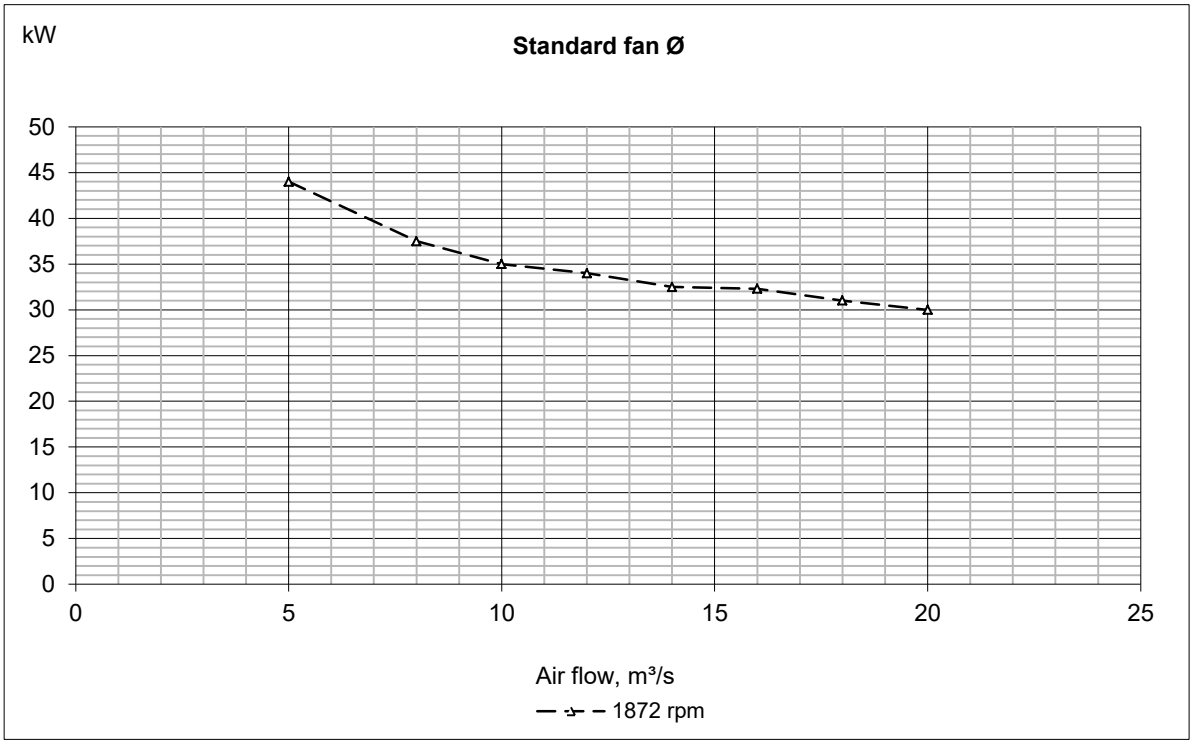

BSU
calculated value
Smoke Emission
(measured according to ISO 10054)
0.06
0.05
0.04
0.03
0.02
0.01
0
0
100
200
300
400
500
600
700
800
kW
Prime Power 1800 rpm
Standby Power 1800 rpm

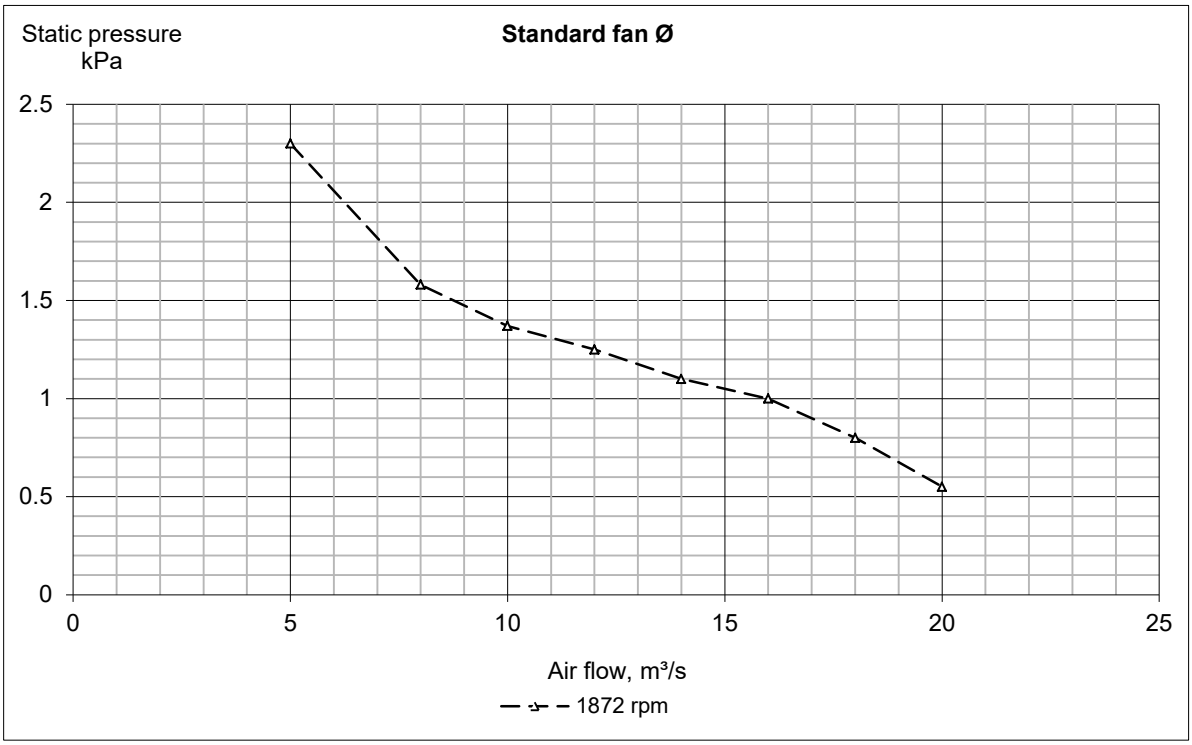

FSN
Smoke Emission
according to ISO 10054
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
100
200
300
400
500
600
700
800
kW
Prime Power 1800 rpm
Standby Power 1800 rpm


Fuel Consumption
l/h
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
kW
Prime Power 1800 rpm
Standby Power 1800 rpm


Derating
35%
30%
25%
20%
15%
10%
5%
0%
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
Altitude
Prime Power 1800 rpm
Standby Power 1800 rpm


Sound power level engine body
1/3 octave band analysis
dB (A)
120
110
100
90
80
70
60
50
40
20
31.5
50
80
125
200
315
500
800
1.25
2k
3.15
5k
8
12.5
20k
Frequency Hz
Prime Power 1800 rpm
Standby Power 1800 rpm


kW
Standard fan Ø
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
Air flow, m³/s
1872 rpm


Static pressure
kPa
Standard fan Ø
2.5
2
1.5
1
0.5
0
0
5
10
15
20
25
Air flow, m³/s
1872 rpm

TYPICAL SUBMITTAL DATA

BASE MODEL: 573RSL4033 **Winding:** 570075 **Date:** 03/12/19

Kilowatt ratings at:	1800 RPM	60 Hertz		12 Leads	
kW (kVA)	3 Phase	0.8 Power Factor		Drip-proof or Open Enclosure	
	CONTINUOUS ①②			STANDBY ①②	
Voltage*	NEMA B / 80°C	NEMA F / 105°C	NEMA H / 125°C	NEMA F / 130°C	NEMA H / 150°C
240/480	570 (713)	680 (850)	700 (875)	700 (875)	765 (956)
220/440	595 (744)	680 (850)	725 (906)	730 (913)	765 (956)
208/416	570 (713)	650 (813)	685 (856)	700 (875)	725 (906)
200/400	550 (688)	626 (783)	644 (805)	652 (815)	666 (833)
190/380	525 (656)	595 (744)	595 (744)	595 (744)	595 (744)

① Rise by resistance method, Mil-Std-705, Method 680.1b. ② Machine rated for Max Ambient of 40°C, Max Altitude 3300 ft

Submittal Data: 480 Volts*, 700 kW, 875 kVA, 0.8 P.F., 1800 RPM, 60 Hz, 3 Phase **High Wye CONNECTION**

Mil-Std-705B Method	Description	Value	Units	Mil-Std-705C Method	Description	Value	Units
301.1b	Insulation Resistance	>1.5 Meg	Ohms	505.3b	Overspeed	2250	RPM
302.1a	High Potential Test			507.1c	Phase Sequence CCW-ODE	ABC	
	Main Stator	1960	Volts	508.1c	Voltage Balance, L-L or L-N	0.2%	
	Main Rotor	1500	Volts	601.4a	L-L Harmonic Max - Total (Distortion Factor)	5.0%	
	Exciter Stator	1500	Volts				
	Exciter Rotor	1500	Volts	601.4a	L-L Harmonic Max - Single	3.0%	
	PMG Stator	1500	Volts	601.1c	Deviation Factor	5.0%	
401.1a	Stator Resistance, Line-to-Line High Wye Connection	0.00740	Ohms	---	TIF (1960 Weightings)	<50	
				---	THF (IEC, BS & NEMA Weightings)	<2%	
	Rotor Resistance	0.472	Ohms				
	Exciter Stator	23	Ohms				
	Exciter Rotor	0.045	Ohms				
	PMG Stator	2.1	Ohms				
410.1a	No-Load Exciter Field Amps at 480 Volts Line-to-Line	0.65	A DC	**Additional Prototype Mil-Std Methods are Available on Request.**			
420.1a	Short Circuit Ratio	0.489					
421.1a	Xd Synchronous Reactance	3.090	PU	--	Generator Frame	573	
		0.814	Ohms	--	Type	MagnaMax	
422.1a	X2 Negative Sequence Reactance	0.217	PU	--	Insulation	Class H	
		0.057	Ohms	--	Coupling - Single Bearing	Flexible	
423.1a	X0 Zero Sequence Reactance	0.058	PU	--	Amortisseur Windings	Full	
		0.015	Ohms	--	Excitation	Ext. Voltage Regulated, Brushless	
425.1a	X'd Transient Reactance	0.153	PU	--	Voltage Regulator	DVR2000E+	
		0.040	Ohms	--	Voltage Regulation	0.25%	
426.1a	X''d Subtransient Reactance	0.132	PU				
		0.035	Ohms				
--	Xq Quadrature Synchronous Reactance	1.250	PU	--	Cooling Air Volume	1400	CFM
		0.329	Ohms	--	Heat rejection rate	2127	btu/min
427.1a	T'd Transient Short Circuit Time Constant	0.127	Sec	--	Full load current	1052.5	Amps
				--	Minimum input hp required	988.5	HP
428.1a	T''d Subtransient Short Circuit Time Constant	0.009	Sec	--	Full load torque	2883	Lb-ft
				--	Efficiency at rated load	94.9%	
430.1a	T'do Transient Open Circuit Time Constant	1.67	Sec				
432.1a	Ta Short Circuit Time Constant of Armature Winding	0.015	Sec	--	Weight	3400	lbs

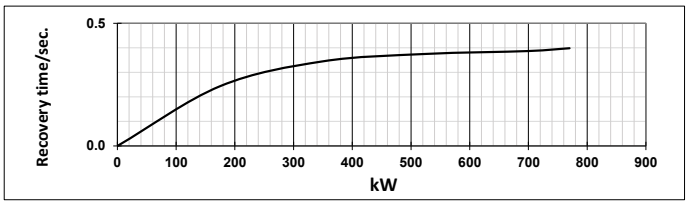
** Voltages refer to Wye (Star) connection, unless otherwise specified.* 3/12/2019

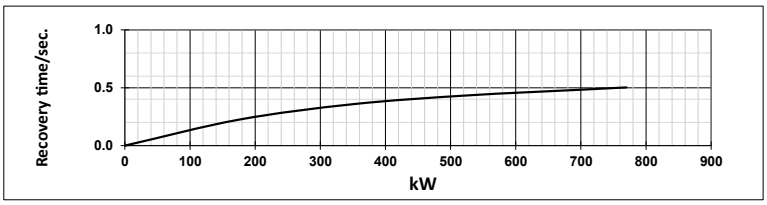
TYPICAL DYNAMIC CHARACTERISTICS

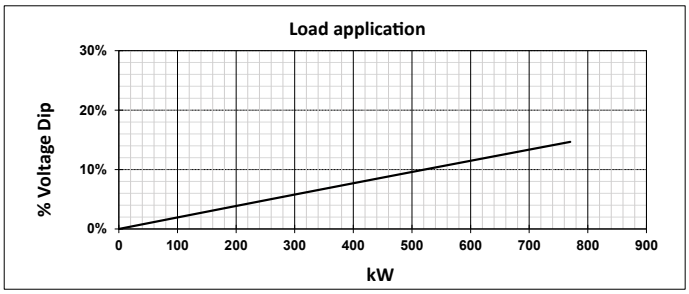
BASE MODEL: 573RSL4033

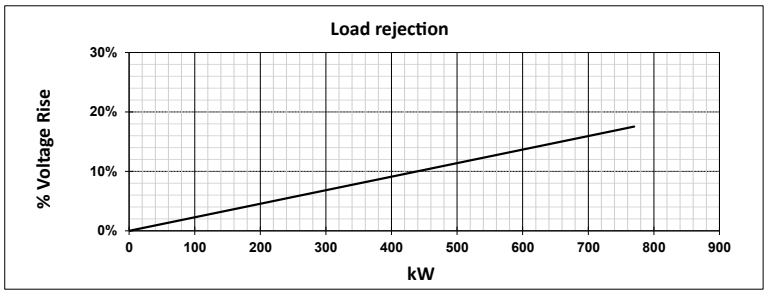
Date: 03/12/19

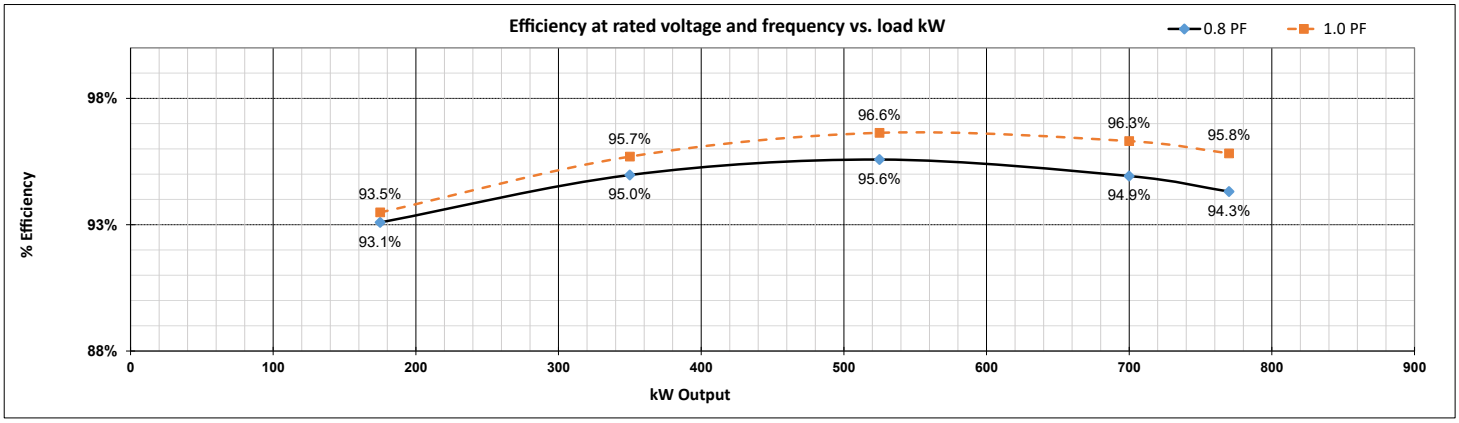
Submittal Data: 480 Volts*, 700 kW, 875 kVA, 0.8 P.F., 1800 RPM, 60 Hz, 3 Phase

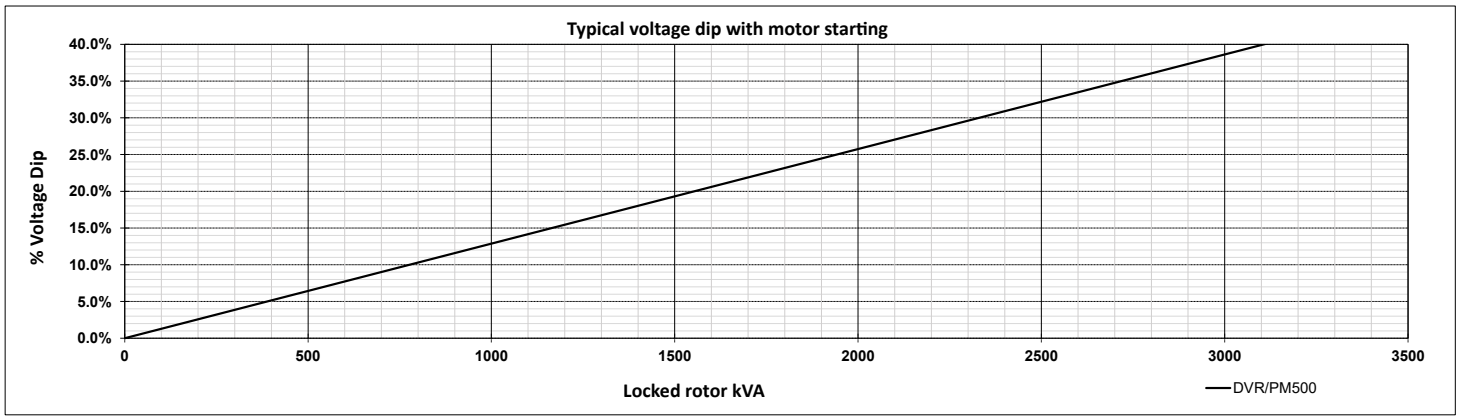












3/12/2019

ENGINE CONTROL PANEL





NEW FEATURES

- Built-In Redundant Ethernet
- Power Measurement Class 1
- Direct Connect Up to 690 VAC
- AnalogManager & Editable Screens
- Multi-Interface ToolKit Connectivity
- Faceplate with Tactile Buttons
- Drop-In Replacement

DESCRIPTION

Woodward raised the standard in genset paralleling control and power management system with the easYgen-3000XT Series controllers. These controllers come with standardized software that is simple to configure, yet easily customized for individual applications. Enhanced connectivity enables fast, reliable, and secure interfacing to other controls and communications systems while the enhanced hardware is a drop-in replacement for previous generation easYgen-3000 Series Controls.

Targeted at enabling complex power management applications, the easYgen-3500XT supports easYgen | GC-3000XT to manage a large genset fleet of up to 496 sets and easYgen | LS-6XT to control up to 64 synchronizing breaker or manual switches on up to 128 complex bus segments. Redundant load sharing is selectable using Ethernet B and C networks for enhanced reliability. The control combines complete engine-generator control and protection with advanced, peer-to-peer paralleling functionality and innovative features in a robust, attractive, user-friendly and all-in-one package. The easYgen-3500XT controls are designed to directly connect up to 690Vac and operate to 4000m above sea level without derating.

The easYgen-3500XT is available in two packages. P1, focused on complex paralleling applications provides redundant Ethernet communication, LS-5 connectivity, and standard I/O set, while P2, Co-Gen/CHP model offers expanded onboard I/O set, three-phase busbar voltage measurement capability and phase rotation monitoring between gen-busbar and busbar-utility. These packages are available without a display in a rugged metal housing suitable for back panel installations (easYgen-3400XT-P1 and easYgen-3400XT-P2 respectively). A sophisticated touch screen remote panel (RP-3000XT) complements as an operator control panel. A version of easYgen-3500XT (easYgen-3500XT-P1-LT and easYgen-3500XT-P2-LT) is designed to operate down to -400^{0}C for outdoor applications.

FEATURES

- Enables several power generation topologies. Some frequently used are:
  - only with easYgen-3500XT: 32 gensets, one generator group breaker and one mains circuit breaker
  - with easYgen-3500XT and LS-5: 32 gensets and 16 breakers (Tie/GGB/MCB) or 16 gensets and 32 breakers on CAN bus
  - with easYgen-3500XT and LS-6XT: 32 gensets and 32 breakers (Tie/GGB/MCB) on single or redundant Modbus/TCP
  - with easYgen-3500XT and GC-3000XT: 496 gensets, one generator group breaker and one mains circuit breaker
  - with easYgen-3500XT, LS-6XT and GC-3000XT: The control topology is cascaded in three layers. Layer-1 consists of easYgen (and also LS-6XT), Layer-2 group controls and Layer-3 LS-6XT. At Layer-1 total 496 gensets (16 x 31), at Layer-2 16 Group controllers and at Layer-3 64 LS-6XT on up to 128 segments are supported. Communication between Layer-1 and Layer-2 controls is CAN, Ethernet A or hot redundant CAN/Ethernet A and between Layer-2 and Layer-3 controls is Ethernet B, Ethernet C or hot redundant Eth B/Eth C.
- Run-up synchronization/Dead Field Paralleling to quickly get several synchronous generators onto the load
- Three-phase true RMS power sensing with Class I accuracy
- Operation modes: AUTO, STOP, MANUAL, and TEST - accessible through faceplate or discrete input
- Breaker control: Slip frequency/phase matching synchronization, open/close control, breaker monitoring
- Load transfer: open/closed transition, interchange, soft loading/unloading, Utility parallel
- Load share and device-to-device communication over CAN, Ethernet or hot redundant ETH/ETH, CAN/ETH
- Remote control via interface (Modbus TCP, Modbus RTU) and via discrete/analog inputs for adjusting speed, frequency, voltage, power, reactive power, and power factor set-points
- Freely configurable PID controllers for various control purposes, such as heating circuit control (CHP applications), water level, fuel level, pressure, and/or other process variables
- Direct support to several ECUs: Scania S6, MTU ADEC ECU7/8/9, Volvo EMS2 & EDC4, Deutz EMR2 & EMR3, MAN MFR/EDC7, SISU EEM, Cummins and Woodward EGS02 ECU
- Modbus master and Modbus data telegram mapper support with dedicated PC tools
- “System Update” function for online troubleshooting and adding/removing generator sets
- Time/Date synchronization over Simple Network Time Protocol (SNTP)
- Cylinder head/exhaust temperature monitoring (Temperatures come from J1939 or CANopen devices)
- Woodward ToolKit™ software for flexible setup from a single connection to the network. The ToolKit can be accessed either via USB, or via Ethernet, or via CAN ports
- Multi-lingual capability: English, German, Spanish, French, Italian, Portuguese, Japanese, Chinese, Russian, Turkish, Polish, Slovakian, Finnish, Swedish and an empty slot for custom language via a dedicated MS Excel based PC tool

SPECIFICATIONS

Power supply ..... 12/24 V_{DC} (8 to 40 V_{DC})
Intrinsic consumption ..... max. 22 W (LT: max.32 W)
Ambient temperature (operation) ..... -20 to 70 °C (LT: -40 to 70 °C)
Ambient temperature (storage) ..... -30 to 80 °C / -22 to 176 °F
Ambient humidity ..... 95%, non-condensing
Voltage (software configurable) ..... (⅄/Δ)
100 V_{AC} Rated (V_{rated}) ..... 69/120 V_{AC}
Max. value (V_{max}) ..... 86/150 V_{AC}
***and** 400 /600 V_{AC}* Rated (V_{rated})* ..... 400/690 V_{AC}
Max. value (V_{max}) ..... 520/897 V_{AC}
Rated surge volt. (V_{surge}) ..... 6.0 kV
Accuracy ..... Class 0.5
Measurable alternator windings . 3p-3w, 3p-4w, 3p-4w OD, 1p-2w, 1p-3w
Setting range ..... primary ..... 50 to 650,000 V_{AC}
Linear measuring range ..... 1.25×V_{rated}
Measuring frequency ..... 50/60 Hz (30 to 85 Hz)
High Impedance Input; Resistance per path ..... 2.5 MΩ
Max. power consumption per path ..... < 0.15 W
Current (Isolated, software configurable) Rated (I_{rated}) ..... 1A or 5A
Linear measuring range ..... I_{gen} = 3.0×I_{rated}
$I_{mains/ground}$ = 1.5×I_{rated}
Setting range ..... 1 to 32,000 A
Burden ..... < 0.10 VA
Rated short-time overcurrent (1 s) ..... [1] 50×I_{rated}, [5] 10×I_{rated}
Accuracy ..... Class 0.5
Power .....
Setting range ..... 0.5 to 99,999.9 kW/kvar
Accuracy ..... Class 1.0
Discrete inputs ..... isolated
Input range ..... 12/24 V_{DC} (8 to 40 V_{DC})
Input resistance ..... approx. 20 kOhms
Transistor outputs (P2 only) ..... isolated
Rated switching voltage ..... max. 24 V_{DC}
Maximum switching voltage ..... 40 V_{DC}
Maximum switching current ..... 300 mA DC
Isolation Test voltage (<1s) ..... 500 V_{AC}
Isolation voltage (continuously) ..... 100 $V_{AC/DC}$
Relay outputs ..... isolated
Contact material ..... AgCdO
Load (GP) ..... 2.00 A_{AC}@250 V_{AC}
2.00 A_{DC}@24 V_{DC} / 0.36 A_{DC}@125 V_{DC} / 0.18 A_{DC}@250 V_{DC}

* 3 phase 3 wire Δ constellations are limited to 600 V_{AC} system

Analog inputs (isolated) ..... freely scalable
Type 1 ..... 0 to 1 V / 0 to 2000 Ohms / 0 to 20 mA
Resolution ..... 16 Bit
Maximum permissible voltage against genset Ground ..... 9 V
Maximum permissible voltage between genset Ground & PE ..... 100 V
Type 2 (P2 only) ..... 0 to 10 V / 0 to 20 mA
Resolution ..... 14 Bit
Maximum permissible voltage against PE (Ground) ..... 100 V
Maximum differential voltage to other DC Analog Inputs ..... 15 V
Type 3 (P2 only) ..... 0 to 250 Ohms / 0 to 2500 Ohms
Resolution ..... 14 Bit
Maximum permissible voltage against PE (Ground) ..... 100 V
Maximum differential voltage to other DC Analog Inputs ..... 10 V
Analog outputs (isolated) ..... freely scalable
Type 1 ..... ± 10 V / ± 20 mA / PWM
Basic insulation voltage (continuously, AVR_{out}) ..... 500 V_{AC}
Reinforced insulation voltage (continuously, AVR_{out}) ..... 300 V_{AC}
Insulation voltage (continuously, Gov_{out}) ..... 100 V_{AC}
Resolution ..... 12 Bit
Output ± 10 V (scalable) ..... internal resistance
Output ± 20 mA (scalable) ..... maximum load 500 Ohms
Type 2 (P2 only) ..... 0/4 to 20 mA
Insulation voltage (continuously) ..... 100 V_{AC}
Insulation voltage (test; >2 s) ..... 1700 V_{AC}
Resolution ..... 12 Bit
Output ..... maximum load 500 Ohms
Housing Front panel flush mounting ..... Plastic housing
Dimensions WxHxD ..... 282 × 216 × 96 mm
Front cutout WxH ..... 249 [+1.1] × 183 [+1.0] mm
Connection ..... screw/plug terminals 2.5 mm²
Front ..... insulating surface
Sealing Front ..... IP66 (with screw fastening)
Front ..... IP54 (with clamp fastening)
Back IP20
Weight ..... approx. 1,850 g
Housing Back panel mounting ..... Powder Coated Sheet metal housing
Dimensions WxHxD P1: ..... 250 × 228 × 50 mm
P2: ..... 250 × 228 × 84 mm
Connection ..... screw/plug terminals 2.5 mm²
Protection system ..... IP 20
Weight ..... approx. 1,750 g
Disturbance test (CE) ..... tested according to applicable IEC standards
Listings ..... CE, UL, EAC, VDE, VDE-AR-N 4105/ 4110, CSA
Marine ..... LR (Type Approval), ABS (Type Approval)

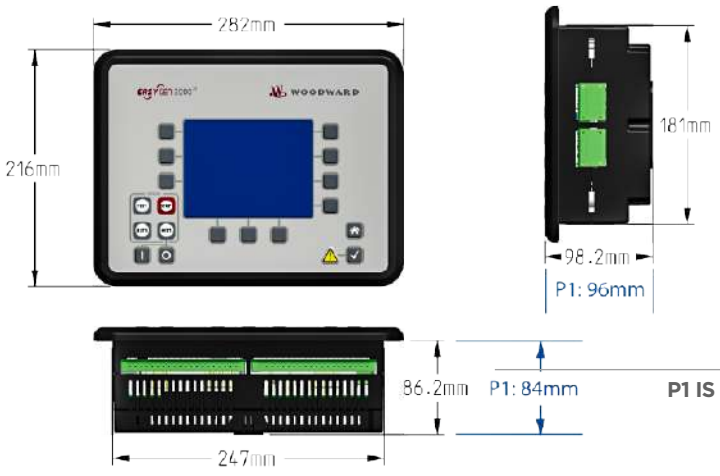
Product Specification
37583

- Premium genset control for complex paralleling applications of up to 32 gensets
- Prime Power & Cogeneration (CHP)
- Peak shaving operation
- Emergency operation
- Import/Export operation
- Islanded & Utility parallel operation
- Group controller and LS-6XT support to manage large fleet of gensets and circuit breakers
- Run-Up Synchronization
- Built-in active voltage regulation
- Complete engine, generator and utility protection
- Up to 9 communication ports: 3xEthernet, 3xCAN (CANOpen and J1939), RS-485, USB, Interface expansion card
- Customizable logic, HMI screens, and alarms
- Dedicated low temperature display variants
- UL 61010, UL 6200, CSA, RoHS 2, and Marine (ABS, LR) Compliance

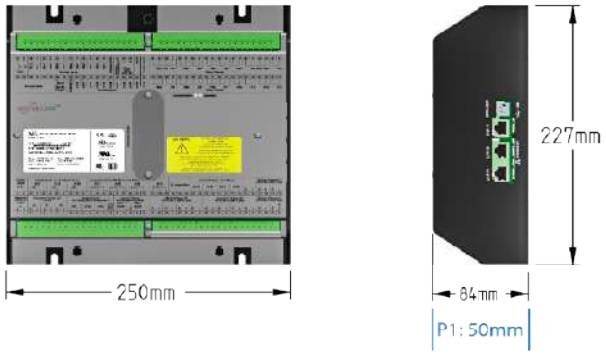
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DIMENSIONS

PLASTIC HOUSING FOR FRONT PANEL MOUNTING



METAL HOUSING FOR CABINET MOUNTING



P1 IS MORE COMPACT (NOTE DEPTH/HEIGHT IN BLUE)

PowerPact™ and P-Frame



Section 1—General Information

Introduction

PowerPact™ P- frame electronic trip molded case circuit breakers are designed to protect electrical systems from damage caused by overloads, short circuits, and ground faults. All circuit breakers are designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent. Electronic trip molded case circuit breakers use an electronic trip system to signal the circuit breaker to open automatically.

The PowerPact P-frame (1200 A frame size) circuit breakers are dual rated to UL 489 and IEC 60947-2. The Compact NS1600 (1600 A frame size) and NS1600b circuit breakers are rated to IEC 60947-2 only.

P-frame molded case circuit breakers are available with either a basic ET 1.0I electronic trip system or with a more advanced Micrologic™ trip system. Electronic trip motor circuit protectors (trip system ET 1.0M), which trip on short circuit only, and automatic molded case switches, which trip at a predetermined self-protection level only, are also available for special applications. All of these circuit breakers are available labeled as Square D™ or Schneider Electric™ (formerly MerlinGerin™, Federal Pioneer ™, or Federal Pacific™).

P-frame electronic trip circuit breakers:

- Provide overload and short-circuit protection
- Are true RMS sensing devices
- Provide means to manually disconnect power to the circuit
- Provide enhanced coordination by their adjustability
- Provide high interrupting ratings and withstand ratings

Circuit breakers with Micrologic trip units can also:

- Provide integral equipment ground-fault protection or alarm
- Provide communications
- Provide power monitoring
- Provide protective relaying functions
- Provide zone-selective interlocking (ZSI), which can reduce damage in the event of a fault

Specifications

Electronic trip molded case circuit breakers haveamolded case made ofaglass-reinforced insulating material (thermal set composite resin) that provides high dielectric strength. These circuit breakers:

- Are available in either dual-rated Underwriters Laboratory® (UL ®)/International Electrotechnical Commission® (IEC ®) or IEC-only constructions
- Are also Canadian Standard Association® (CSA ®) and Association of the Electrical Sector® (ANCE ®) certified (dual-rated UL/IEC circuit breakers only)
- Are manufactured in unit-mount, I-Line™ and drawout (P-frame) constructions
- Are available with either type ET or Micrologic electronic tripping systems
- Provide optional power monitoring, communications, protective relaying, integral ground-fault protection for equipment and zone-selective interlocking functions
- Share common tripping of all poles
- Can be mounted and operated in any position1
- Are equipped with an externally-accessible test port for use with hand-held and full-function test sets
- Are available in motor circuit protector and automatic molded case switch constructions
- Can be reverse connected, without restrictive LINE and LOAD markings
- Meet the requirements of National Electrical Code® (NEC ®) Sections 240.6 by providinga means to seal the rating plug and trip unit adjustments

Codes and Standards

P-frame electronic trip circuit breakers and switches are manufactured and tested in accordance with the following standards:

Table 1: Standards

P-Frame Circuit Breakers	P- Frame Switches
UL 489[1] IEC Standard 60947-2 CSA C22.2 No 5 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE, CCC	UL 489[2] IEC Standard 60947-3 CSA C22.2 No 5 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE

1 PowerPact P-frame circuit breaker is in UL File E63335.

2 PowerPact P-frame switch is in UL File E103740.

Circuit breakers should be applied according to guidelines detailed in the NEC and other local wiring codes.

Circuit Breaker Ratings

Interrupting Rating

The interrupting rating is the highest current at rated voltage the circuit breaker is designed to safely interrupt under standard test conditions. Circuit breakers must be selected with interrupting ratings equal to or greater than the available short-circuit current at the point where the circuit breaker is applied to the system (unless it is a branch device in a series rated combination). Interrupting ratings are shown on the front of the circuit breaker. For grounded B phase interrupting ratings, see Data Bulletin 2700DB0202.

Table 2: UL/IEC Circuit Breaker Interrupting Ratings

Circuit Breaker [1]	UL/CSA Rating (50/60 Hz)				IEC 60947-2 Rating (50/60 Hz)			
	3 Phase			Grounded B Phase (1Ø-3Ø)	240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac	240 Vac 2P	Icu	Ics	Icu	Ics
MG	65 kA	35 kA	18 kA	65 kA	50 kA	25 kA	35 kA	20 kA
MJ	100 kA	65 kA	25 kA	65 kA	65 kA	35 kA	50 kA	25 kA
PG	65 kA	35 kA	18 kA	65 kA	50 kA	25 kA	35 kA	20 kA
PJ	100 kA	65 kA	25 kA	65 kA	65 kA	35 kA	50 kA	25 kA
PK	65 kA	50 kA	50 kA	65 kA	50 kA	25 kA	50 kA	25 kA
					125 kA	65 kA	85 kA	45 kA
RG	65 kA	35 kA	18 kA	35 kA	50 kA	25 kA	35 kA	20 kA
RJ	100 kA	65 kA	25 kA	100 kA	65 kA	35 kA	50 kA	25 kA
RK	65 kA	65 kA	65 kA	65 kA	85 kA	65 kA	70 kA	55 kA
RL	125 kA	100 kA	50 kA	125 kA	125 kA	65 kA	85 kA	45 kA

[1] The K interrupting rating is recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.

Application Ratings

The voltage rating is the highest voltage for the electrical system on which the circuit breaker can be applied. The frequency rating indicates the system frequency for which the circuit breaker is intended. The withstand rating is used to improve system coordination by maximizing the current level at which the circuit breaker trips with no intentional delay. The withstand rating is the level of RMS symmetrical current that a circuit breaker can carry in a closed position for a stated period of time.

Table 3: Voltage, Frequency and Withstand Ratings

Circuit Breaker	Voltage Rating	Frequency Rating	Withstand Rating at 480 Vac[1]
PG, PK	600 Vac	50/60 Hz (UL and IEC)	25 kA (0.5 sec)
PJ	600 Vac	50/60 Hz (UL and IEC)	10 kA (0.5 sec)

1 A system coordination study should be done for optimum circuit breaker coordination.

Ampere Rating = Sensor Size x Rating Plug Setting ($I_r = I_n$ x Rating Plug Setting)

Ampere Rating (Continuous Current Rating)

The ampere rating (or continuous current rating) (Ir) is the maximum current that a circuit breaker can carry. The sensor size (I^n) is the maximum ampere rating for a specific circuit breaker and is based on the size of the sensor plug inside the circuit breaker. This value is printed below the trip unit on the sensor plug.

NOTE: The maximum ampere rating a circuit breaker family can carry is called the frame size. Sensor size is less than or equal to frame size.

The ampere rating of a type ET electronic trip circuit breaker is equal to the current sensor size (I^n).

The ampere rating of a Micrologic™ electronic trip circuit breaker is determined by the mathematical equation:

The rating of the plug varies the circuit breaker ampere rating as a function of its sensor size. Rating plugs have nine dial settings; the multiplier values corresponding with each setting are printed on the rating plug. The maximum setting range is 0.4–1.0 x I_n.

Table 4: Minimum Enclosure Sizes for Fixed-Mounted Circuit Breakers

Circuit Breaker Rating	Enclosure Dimensions (h x w x d)		Ventilation Area			
	3P Circuit Breaker	4P Circuit Breaker	Top		Bottom	
P-Frame, ≤ 800 A, 100% Rated P-Frame, ≤ 1200 A, Standard Rated	51.9 x 20.25 x 7.75 in. (1318.3 x 514.4 x 196.9 mm)	51.9 x 23.01 x 7.75 in. (1318.3 x 584.4 x 196.9 mm)	—	—	—	—
P-Frame, ≤ 1200 A, 100% Rated	62.25 x 23 x 14.75 in. (1581.2 x 584.2 x 374.7 mm)	62.25 x 25.76 x 14.75 in. (1581.2 x 654.2 x 374.7 mm)	16.5 in.	10,645 mm	16.5 in.	10,645 mm

1 RLTB or RL3TB kits may extend beyond end of enclosure when using minimum enclosure size.

Operating Conditions

Temperature

To meet the requirements of the UL489 Standard, molded case circuit breakers are designed, built and calibrated for use on 50/60 Hz ac systems in a 40°C (104°F ambient environment. Electronic trip circuit breakers, however, are designed to react only to the magnitude of the current flowing through the circuit breaker and are inherently ambient insensitive. Both UL/IEC and IEC-only circuit breakers may be operated at temperatures between -25°C and +70°C (-13°F and 158°F). For temperatures other than 40°C (104°F), the circuit breakers must be re-rated as shown.

Table 5: Temperature Re-rating Values

Maximum Ambient Temperature													
°F	158	140	122	104	86	77	68	50	32	14	-4	-13	-22
°C	70	60	50	40	30	25	20	10	0	-10	-20	-25	-30
Current	0.75	0.83	0.92	1.00	1.07	1.11	1.14	1.21	1.27	1.33	1.39	1.42	1.44

Altitude

Circuit breakers are suitable for use at altitudes up to 13,100 ft. (4000 m). For altitudes higher than 6560 ft. (2000 m), circuit breakers must be derated as shown.

Table 6: Altitude Derating Values Per ANSI C37.20.1 Table 10

Altitude	≤ 6,600 ft. (≤ 2,000 m)	8,500 ft. (2,600 m)	13,000 ft. (3,900 m)
Voltage	1.00	0.95	0.80
Current	1.00	0.99	0.96

Vibration

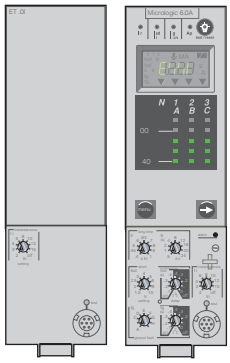
PowerPact circuit breakers meet IEC 60068-2-6 Standards for vibration.

- 2 to 13.2 Hz and amplitude 0.039 in. (1 mm)
- 13.2 to 100 Hz constant acceleration

Storage Temperature

Circuit breakers with trip units without LCD displays may be stored in the original packaging at temperatures between -58°F (-50°C) and 185°F (85°C). For circuit breakers with trip units with LCD displays, this range is -40°F (-40°C) to 185°F (85°C).

Trip System



ET Electronic Trip Unit

Micrologic Electronic Trip Unit

The trip system causes the circuit breaker to open automatically under overload, short-circuit, or equipment ground-fault conditions. Electronic trip circuit breakers give the customer more versatility to achieve coordination with features such as adjustable instantaneous pickup and high withstand ratings.

The type ET and the Micrologic trip systems consist of current sensors, a microprocessor-based trip unit, and a tripping coil. The tripping coil is a flux transfer solenoid that requires no external power source. All type ET and Micrologic protective functions are completely fault powered.

Micrologic Trip System

Features found in Micrologic™ electronic trip circuit breakers, such as universally interchangeable rating plugs, adjustable long-time pickups, and 100% ratings also provide capacity for future growth.

The integral equipment ground-fault sensing capabilities available with Micrologic trip systems mean that there are fewer parts and pieces to purchase, mount and wire. These capabilities include integral ground-fault protection for equipment, which causes the circuit breaker to trip when a ground fault is detected, as well as integral ground-fault alarm, which does not trip the circuit breaker but sends an alarm when a ground fault is detected.

Certain Micrologic trip systems also offer the customer true power management system solutions through communication. These trip units can communicate with other circuit breakers in the system and also with a power monitoring system. Communication is by Modbus® and does not require proprietary software.

Communication between trip units allows zone-selective interlocking (ZSI) between circuit breakers at different levels in the system. ZSI reduces fault stress by allowing the upstream circuit breaker closest to the fault to ignore its preset delay time and trip without any intentional delay on a short circuit or ground fault. For more information on ZSI, see data bulletin Reducing Fault Stress with Zone-Selective Interlocking.

Communication witha power monitoring system through a communications network allows a ground fault to be reported without interrupting power to the system. It also allows the power monitoring system to remotely report power usage, current flow, and trip history.

Instantaneous OFF Feature

Micrologic™ 5.0 and 6.0 Standard, A, P, andHelectronic trip units provide the unique ability to turn the instantaneous tripping function OFF. Turning off the instantaneous trip function increases the current level at which the circuit breaker will trip with no intentional delay to the level of the short-time withstand rating. This current level is typically much higher than any of the pickup levels provided by the adjustable instantaneous feature. Therefore, using the instantaneous OFF feature improves coordination by allowing the user to take advantage of the circuit breaker withstand rating.

Internal Operating Mechanism

Manually-Operated Circuit Breakers

P-frame manually-operated circuit breakers have a single operating handle that acts directly through the operating mechanism against the contact blades. Multi-pole circuit breakers have a common trip bar for positive action of all poles on manual and automatic operation. These circuit breakers have a trip-free mechanism that allows them to trip even though the operating handle may be restricted (by a handle operating mechanism or padlock attachment) in the I/ON position. If not restricted, the operating handle moves to a position between I/ON and O/OFF when the circuit breaker is tripped.

The face of the manually-operated circuit breaker is marked with standard ON/OFF and international I/O markings to indicate handle position. In addition, the ON/OFF portion of the circuit breaker handle is color-coded green.

Electrically-Operated Circuit Breakers

P-frame circuit breakers are also available with a two-step stored-energy mechanism which can be charged manually or using a motor. The closing time is less than five cycles. Closing and opening operations can be initiated by remote control or by pushbuttons on the front cover. An O-C-O open-close-open) cycle is possible without recharging. Electrically-operated circuit breakers include a motor, shunt trip, and shunt close of the same voltage plus an overcurrent trip switch.

The face of electrically-operated circuit breakers is also marked ON/OFF and I/O, and equipped with a position indicator to show contact position.

Push-to-Trip Button

The push-to-trip button located on the face of each manually-operated circuit breaker is a standard feature on these circuit breakers. This allows the user to manually trip the circuit breaker without risking exposure to live parts. During normal on-off operation, the handle opens and closes the circuit breaker contact but does not exercise the tripping mechanism.

Use the push-to-trip button to:

- Exercise the circuit breaker mechanism
- Check the auxiliary and alarm switch circuits

Section 2 —Electronic Trip Systems

True RMS Current Sensing

The sensing system responds to the flow of current through the circuit breaker. The trip unit samples the current waveform to provide true RMS protection through the fifteenth harmonic. This true RMS sensing gives accurate values for the magnitude of a non-sinusoidal waveform. Therefore, the heating effects of harmonically distorted waveforms are accurately evaluated.

The Micrologic H trip unit provides additional sampling of the waveforms to measure and provide waveform capture of harmonic distortion to the thirty-first harmonic.

Micrologic™ Electronic Trip Systems

The P-frame electronic trip circuit breakers can be equipped with the optional Micrologic trip systems listed below:

Table 7: Micrologic Trip Systems

Model	(LSI) Long-time + Short-time + Instantaneous Protection (UL LIsted, IEC Rated)	(LSIG) Long-time + Short-time + Instantaneous Protection + Equipment Ground-fault Protection (UL LIsted, IEC Rated)
Micrologic Basic Trip Unit	5.0	—
Micrologic A Trip Unit	5.0A	6.0A
Micrologic P Trip Unit	5.0P	6.0P
Micrologic H Trip Unit	5.0H	6.0H

Trip units are designed to protect power circuits and loads. Micrologic trip systems use a set of current transformers (called CTs or sensors) to sense current, a trip unit to evaluate the current, and a tripping solenoid to trip the circuit breaker. Adjustable rotary switches on the trip unit allow the user to set the proper overcurrent or equipment ground-fault current protection required in the electrical system. If current exceeds a set value for longer than its set time delay, the trip system opens the circuit breaker. Alarms may be programmed for remote indications. Measurements of current, voltage, frequency, power, and power quality optimize continuity of service and energy management.

Integration of protection functions in the Application Specific Integrated Circuit (ASIC) electronic component used in all Micrologic trip units guarantees a high degree of reliability and immunity to conducted or radiated disturbances. On Micrologic P and H trip units, advanced functions are managed by an independent microprocessor.

Circuit breakers are shipped with the trip unit long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings. Actual settings required for a specific application must be determined by a qualified consultant or plant engineer. A coordination study is recommended to provide coordination between all circuit breakers in the distribution system.

Table 8: Micrologic™ Trip Unit Features

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)							
	Standard		Ammeter		Power		Harmonics	
			5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
Field-Installable			X	X	X	X	X	X
LI								
LS0								
LSI			X		X		X	
LSIG/Ground-Fault Trip [1]				X		X		X
Ground-Fault Alarm/No Trip [1, 2]					X		X	
Ground-Fault Alarm and Trip [1, 2]						X		X
Adjustable Rating Plugs			X	X	X	X	X	X
True RMS Sensing			X	X	X	X	X	X
UL Listed			X	X	X	X	X	X
Thermal Imagin			X	X	X	X	X	X

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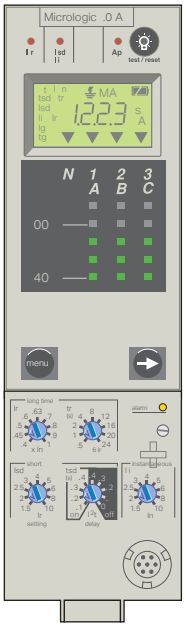
Table 9: Micrologic™ Trip Unit Features (continued)

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)							
	Standard		Ammeter		Power		Harmonics	
			5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
Phase-Loading Bar Graph			X	X	X	X	X	X
LED for Long-Time Pick-Up			X	X	X	X	X	X
LED for Trip Indication			X	X	X	X	X	X
Digital Ammeter			X	X	X	X	X	X
Zone-Selective Interlocking[3]								
Communications			O	O	X	X	X	X
LCD Dot Matrix Display					X	X	X	X
Advanced User Interface					X	X	X	X
Protective Relay Functions					X	X	X	X
Neutral Protection[1]					X	X	X	X
Contact Wear Indication					X	X	X	X
Incremental Fine Tuning of Settings					X	X	X	X
Selectable Long-Time Delay Bands					X	X	X	X
Power Measurement					X	X	X	X
Power Quality Measurements							X	X
Waveform Capture							X	X

1 3Ø, 4W circuits require either a neutral current transformer or a 4-pole breaker.

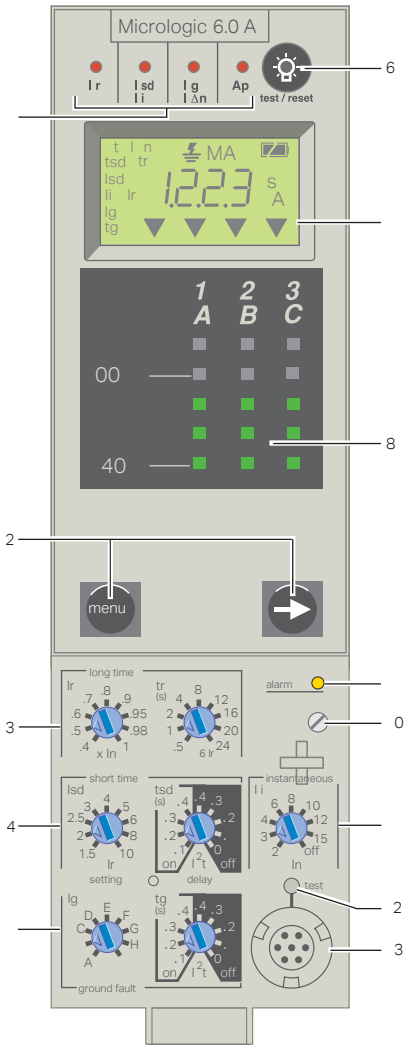
2 Requires M6C Programmable Contact Module.

3 Not available for 2.0A trip units as upstream devices.



Micrologic 5.0A and 6.0A Trip Units

Micrologic™ 5.0A and 6.0A Trip Units with Ammeter



1—Indication of tripping cause
2—Navigation buttons
3—Long-time current setting and tripping delay
4—Short-time pickup and tripping delay
5—Ground-fault pickup and tripping delay
6—Test lamp and reset
7—Digital display
8—Three-phase bar graph and ammeter
9—Overload signal (LED)
10—Long-time rating plug screw
11—Instantaneous pickup
12—Electronic push-to-trip
13—Test connector

Micrologic A trip units protect power circuits and provide current measurements, overload protection, and short-circuit protection. In addition, the 6.0A trip units also provide ground-fault protection for equipment.

Protection Settings

Protection thresholds and delays are set using the rotary switches. The selected values are momentarily displayed in amperes and in seconds. A full-range of long-time settings are available via the field-installable rating plug:

- Overload protection (true RMS long-time protection)
- Thermal imaging (active thermal imaging before and after tripping)
- Short-circuit protection:
  - Short-time RMS
  - I^2t ON or OFF for short-time delay
- Instantaneous protection
- Ground-fault protection for equipment:
  - Residual ground-fault protection for equipment
  - Source ground-return ground-fault protection for equipment
  - Modified differential ground-fault protection (MDGF) for equipment
- Neutral protection on four-pole circuit breakers
- Zone-Selective Interlocking:
  - ZSI terminal block may be used to interconnect a number of trips to provide total discrimination for short-time and equipment ground-fault protection, without delay for tripping.

Ammeter Measurements

Micrologic A trip units measure the true RMS value of currents. They provide continuous current measurement from 0.2 to 20 x I_n with an accuracy of 1.5% (including sensors). No auxiliary source is needed where I > 0.2 x I_n . The optional external power supply (24 Vdc) makes it possible to display currents where I<0.2 x I_n and to store values of the interrupted current.

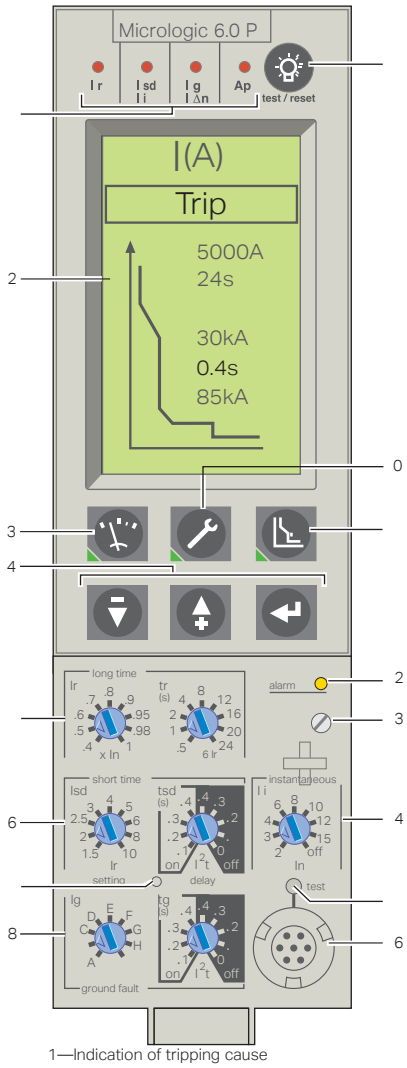
A digital LCD screen continuously displays the most heavily loaded phase (Imax) or displays the I_A, I_B , I_C, I_g, and (on 4P circuit breakers only) I_N stored current and setting values by Bsuccessivelg y pressing the navigation button.

Communication Network

In conjunction with an optional communication network, the trip unit transmits the following parameters:

- Setting values
- All ammeter measurements
- Tripping causes

Micrologic™ 5.0P and 6.0P Trip Units with Power Metering



1—Indication of tripping cause
2—High resolution screen
3—Measurement display
4—Navigation buttons
5—Long-time current setting and tripping delay
6—Short-time pickup and tripping delay
7—Hole for settings lockout pin
8—Ground-fault pickup and tripping delay
9—Test lamp and indication reset
10—Maintenance indicators
11—Protection settings
12—Overload signal (LED)
13—Long-time rating plug screw
14—Instantaneous pickup
15—Electronic push-to-trip
16—Test connector

Micrologic P trip units provide power metering and extended protection in addition to the adjustable protection functions of the Micrologic A trip unit.

Protection Settings

The adjustable protection functions of the 5.0P and 6.0P trip units are identical to those of MicrologicA trip unit (overloads, short circuits, equipment ground-fault protection). These units also feature:

- Fine adjustment

  Within the range below the rotary switch setting, fine adjustments of pickups/delays in steps of 1 A/s (except for short-time and ground-fault) are possible on the keypad or remotely by the communication network.

- Inverse definite minimum time lag (IDMTL) setting.

  Coordination with fuse-type or medium-voltage protection systems is optimized by adjusting the long-time delay curve around 6 x I_r axis. This setting ensures better coordination with certain loads.

- Neutral protection

  On three-pole circuit breakers, neutral protection may be set using the keypad or remotely using the communication network to one off four positions: OFF, 1/2N (1/2 x I_n), 1N (1 x I_n), or 1.6N (2 x I_n).

  NOTE: Neutral protection is disabled if long-time curve is set to one of the IDMTL protection settings.

- Configuring Alarms and Other Protection Functions

  When the cover is closed, the keypad may no longer be used to change the protection settings, but it still provides access to the displays for measurements, histories, indicators, etc. Depending on the thresholds and time delays set, the Micrologic P trip unit monitors current, voltage, power, frequency, and phase sequence. Each threshold overrun may be signalled remotely via the communication network.

Each threshold overrun may be combined with tripping (protection) or an indication carried out by an optional M6C programmable contact (alarm), or both (protection and alarm).

Maintenance Record

The maintenance record can be consulted using the full-function test kit or remotely via the communication network. It can be used as an aid in troubleshooting and to assist scheduling for device maintenance operations. Recorded indications include:

- Highest current measured
- Operation counter (cumulative total and total since last reset)
- Number of test kit connections
- Number of trips in operating mode

Load Shedding and Reconnection Parameters

Load shedding and reconnection parameters can be set according to the power or the current flowing through the circuit breaker. Load shedding is carried out by a remote computer via the communication network or by an M6C programmable contact.

Indication Option Via Programmable Contacts

The M6C programmable contact may be used to signal threshold overruns or status changes. It can be programmed using the keypad on the Micrologic P trip unit or remotely using the communication network. The contact is required to obtain data from the protective relay functions on Type P and Type H trip units.

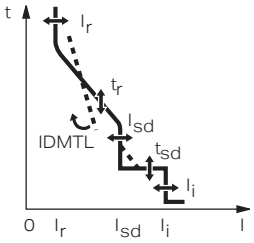


Table 10: Micrologic 5.0P and 6.0P Trip Unit Settings

Long-Time (RMS) Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I_r	$I_r = I_n$ x...	IEC	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00	
		$I_r = I_n$ x...	UL	0.40	0.45	0.50	0.60	0.63	0.70	0.80	0.90	1.00	
		Other Ranges are Available by Changing Rating Plug											
	Maximum Time Delay(s) Accuracy: 0 to –20%	t_r at 1.5 x I_r		12.5	25	50	100	200	300	400	500	600	
		t_r at 6 x I_r		0.5	1	2	4	8	12	16	20	24	
		t_r at 7.2 x I_r		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6	
	IDMTL Setting	Curve slope		SIT		VIT		EIT		HV Fuse		DT	
	Thermal Imaging	20 Minutes Before or After Tripping											
Short-Time (RMS) Protection	Current Setting (A) Accuracy: ±10%	$I_{sd} = I_r$ x...		1.5	2	2.5	3	4	5	6	8	10	
	Maximum Time Delay(s) at 10 x I_r	Settings	I^2t OFF	0	0.1	0.2	0.3	0.4					
			I^2t ON		0.1	0.2	0.3	0.4					
		t_{sd}	Min. Trip Time (ms)	20	80	140	230	350					
			Max. Trip Time (ms)	80	140	200	320	500					
Instantaneous Protection	Current Setting (A) Accuracy: ±10%	$I_i = I_N$ x...		2	3	4	6	8	10	12	15	off	

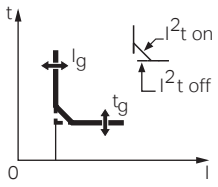


Table 11: Micrologic 6.0P Trip Unit Ground-Fault Settings

Ground-Fault Pickup (A) Accuracy: ±10%		$I_g = I_n$ x...	A	B	C	D	E	F	G	H	J
		$I_n \leq 400$	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		400 A < $I_n \leq 1200$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		I_n >1200 A	500	640	720	800	880	960	1040	1120	1200
Time Delay(s) at 1 x I_n	Settings	I^2t OFF	0	0.1	0.2	0.3	0.4				
		I^2t ON		0.1	0.2	0.3	0.4				
	t_g	Min. Trip Time (ms)	20	80	140	230	350				
		Max. Trip Time (ms)	80	140	200	320	500				

Table 12: Micrologic 5.0P and 6.0P Trip Unit Settings for Protection Functions

			Threshold	Time Delay
Current	Current Imbalance		0.05 to 0.6 x I_{max}	1 to 40 s
	Maximum Current	I_{max}: I_A, I_B, I_C, I_N, I_g	0.2 to 1.0 x I_n	15 to 1500 s
Voltage	Voltage Imbalance		0.02 to 0.3 x V_n	1 to 40 s
	Minimum Voltage	V_{min}	100 to 725 V (Phase Total)	0.25 to 0.5 s
	Maximum Voltage	V_{max}	100 to 1200 V (Between Phases)	0.20 to 5.0 s
Power	Maximum Power	P_{max}	5 to 500 kW	0.2 to 20 s
	Reverse Power	P_r	0.02 to 0.2 x P_n	0.5 to 20 s
Frequency	Minimum Frequency	F_{min}	45 to 65 Hz	0.2 to 5 s
	Maximum Frequency	F_{max}	45 to 540 Hz	0.2 to 5 s
Phase	Sequence	ΔØ	ØA-ØB-ØC or ØA-ØC-ØB	Instantaneous

Table 13: Micrologic 5.0P and 6.0P Trip Unit Settings for Current and Power Load-Shedding

		Pickup		Drop-out	
		Threshold	Time Delay	Threshold	Time Delay
Current	I	0.5 to 1.0 x I_r Per Phase	20% to 80% x t_r	0.3 to 1.0 x I_r per phase	10 to 600 s
Power	P	200 kW to 10 MW	10 to 3600 s	100 kW to 10 MW	10 to 3600 s

Micrologic P trip units are designed to be used with an external 24 Vdc power supply. Current-based protection functions require no auxiliary power source.

Table 14: Micrologic P Use of External 24 Vdc Power Supply

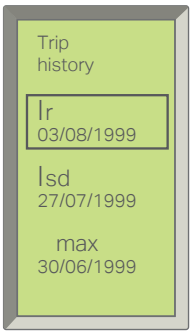
Function	Without 24 Vdc Power Supply at F1 and F2	With 24 Vdc Power Supply at F1 and F2
Fault Protection for LSIG Functions	Yes	Yes
LED Trip Indication	Yes	Yes
LCD Display and Backlight are Functional	Yes [1]	Yes
Ground-Fault Push-to-Trip Button Works for Testing Ground Fault [2]	Yes [1]	Yes
Metering, Monitoring, and History Logs are Functional	Yes [1]	Yes
Communications Between Trip Unit and M2C and M6C Programmable Contact Modules	No	Yes
Operation of M6C Programmable Contact Modul	No	Yes, with separate 24 Vdc power supply for the module
Modbus Communications	No	Yes, with separate 24 Vdc power supply for the circuit breaker communication module

1 If circuit breaker has 100 Vac or more between two phases or phase-to-neutral and is bottom fed or closed in a top fed application.

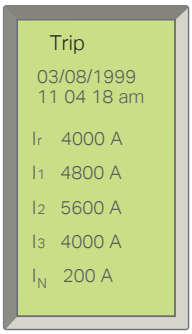
2 Ground-fault push-to-trip button will also be functional if hand-held test kit or full-function test kit is powering the trip unit.

Tripping and Alarm Histories

The last ten trips and ten alarms are recorded in two separate history files that can be displayed on the screen (sample displays are shown).



Trip History



Alarm History

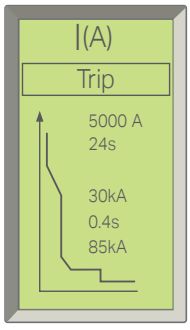
The following information is contained in these files:

Trip History
- Type of fault
- Date and time of fault
- Interrupted current

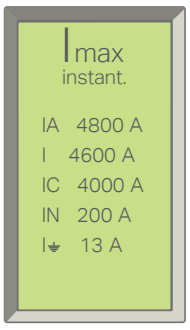
Alarm History
- Type of alarm
- Date and time of alarm
- Values measured at time of alarm

Metering

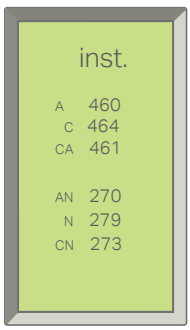
The Micrologic P trip unit calculates in real time the electrical values V, A, W, VAR, VA, Wh, VARh, VAh, Hz, power factor and crest factor. It also calculates demand current and power over an adjustable time period.



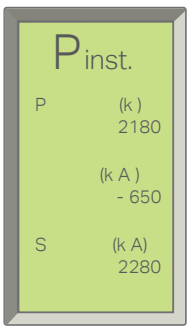
Current Metering



Maximum Current



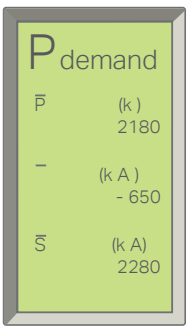
Voltage Metering



Power Metering



Frequency



Power Demand

Section 4—PowerPact P-Frame Molded Case Circuit Breakers

Performance



P-Frame Unit-Mount



P-Frame I-Line



P-Frame Drawout

Providing unparalleled performance and control, the P-frame circuit breakers features the exclusive Micrologic electronic trip units, which allow for a range of sophisticated applications for metering and monitoring. In addition, trip units can be interchanged in the field to allow for maximum flexibility.

The compact size and small footprint of the P-frame circuit breaker permits high density installations in I-Line panelboards and switchboards. These circuit breakers are available in 100% rated construction for all unit-mount circuit breakers and up to 800 A in I-Line circuit breakers to meet a broad range of commercial and industrial application needs.

- Both standard (80%) and 100% rated construction circuit breakers are available in 1200 A with a sensor size range of 250–1200 A.
- Interrupting ratings (AIR):

Voltage	G	J	K
240 Vac	65 kA	100 kA	65 kA
480 Vac	35 kA	65 kA	50 kA
600 Vac	18 kA	25 kA	50 kA

- The P-frame circuit breakers with K interrupting rating are recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.
- Compact circuit breaker size allows for small footprint installations using I-Line panelboards and switchboards. Nine-inch width provides increased density installation.
- Most field-installable accessories are common to all frame sizes for easier stocking and installation.
- Selection of four interchangeable Micrologic trip units available, with Powerlogic power metering and monitoring capabilities available in advanced trip units.
- Field-installable sensor plugs.
- Compatible with Powerlogic systems and high amperage power circuit breakers.
- Built-in Modbus protocol provides an open communications platform and eliminates the need to purchase additional, proprietary network solutions.
- Connection options include bus, cable or I-Line for installation flexibility.
- Additional options are available for 5-cycle closing, stored energy mechanisms and drawn-out mounting.

Electrically-Operated Circuit Breakers

Electrically-operated P-frame circuit breakers are available in I-Line and unit-mount construction up to 1200Aand are denoted in the catalog number by an "M_" suffix. These come equipped with a two-step stored energy mechanism and come standard with a motor assembly. These are available factory-installed only.

Motor assemblies provide on and off control from remote locations. The assemblies contain a spring-charging motor (MCH), a shunt trip (MX) and a shunt close (XF) and are available in standard or communicating versions. An SDE overcurrent trip switch is also included for trip indication.

Table 15: Motors Assembly Voltage Ratings (Vn)

Voltage Type	Voltage Ratings (Vn)
Vac 50/60 Hz	48, 100–130, 220–240, 380–415
Vdc	24–30, 48–60, 110–130, 200–250

Termination Information

Unit-mount circuit breakers and switches have mechanical lugs standard on both ends. I-Line circuit breakers have lugs standard on the O/OFF end. These lugs accept aluminum or copper wire. Manually-operated P-frame circuit breakers are also available in drawout construction.

Control Wiring

Control wiring for unit-mount and I-Line construction is connected to terminals located under the circuit breaker accessory cover. Control wiring for drawout construction is connected to terminals located on the cradle.

NEW FEATURES

- USB 2.0 access through front panel
- Euro-style connector for low voltage connections
- Event Logging
- PMG voltage metering
- Polarity configuration for external inputs
- Configurable cut-in and cut-out frequencies
- Retain/reset configuration of remote adjust



FOUR DIGIT HMI DISPLAY

From intial setup to monitoring regulator status, this display provides innovative, fast, and easy setup.

REGULATION MODES

Single and Three phase (AVR), Manual Field Current Regulation (FCR), Reactive Power Regulation (VAR), and Power Factor Regulation (PF). All modes compatible with control by external devices.

GENERATOR SOFT START

Controlled increase to rated voltage limits overshoot during voltage build-up in AVR modes.

TRUE RMS VOLTAGE SENSING - SINGLE OR THREE PHASE

Directly sense 100 to 600 Volts at 50/60 Hz. Circuitry senses true RMS voltage for superior regulation.

SINGLE PHASE POWER METERING FRAME SIZE SPECIFIC PID SELECTION

Simply select the appropriate frame size and your gains are set.

ROBUST GENERATOR PROTECTION FEATURES

Nine (9) different Alarm and Shutdown protection features, many are customizable for your application including:

- Field Over & Under Excitation
- Instantaneous Field Over Current
- Generator Over & Under Voltage
- Generator Voltage Imbalance
- Generator Loss of Sensing

SPECIFICATIONS

Voltage Regulation - 0.25% over load range at rated power factor and constant generator frequency.
Output Power - 100 Vdc, 4.0 Adc continuous rating and 190 Vdc, 7.5 Adc forcing capability for one minute.
Exciter Field DC Resistance - 18 to 25Ω Range
Remote Voltage Adjustment - +30% of nominal via analog input, +15% via external contacts.
Input Power - 180 to 240 Vac, 250 to 300 Hz PMG power supply
Regulator Sensing - 100 to 600 Vac, 50/60 Hz, 1-phase/3phase
Operating Temperature - From -40°C to +70°C (-40°F to + 158°F)
Storage Temperature - From -40° C to +85°C (-40°F to +185°F)
Ingress Protection - IP52 (front side mounted in conduit box along with swing cover); IP10 (rear side with protective cover)
Shock - 20G in 3 perpendicular planes
Vibration - 2.5G at 5 to 26 Hz; 0.050" double amplitude (27 to 52 Hz); 7G at 53 to 500 Hz
Weight - 3.5 lb. (1361 g)
Humidity Testing - Per MIL-STD-705B, Method 711-D
Salt Fog Testing - Per MIL-STD-810E

EMI Compatibility

Immunity

Meets EN 61000-6-2: 2005 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards- immunity for industrial environments.

Emission

Meets EN 61000-6-4: 2007 Electromagnetic compatibility (EMC) - Part 6-4: Generic Standards - emmission standard for industrial environments

EMI Compatibility Tests

Immunity

- Electrostatic Discharge (ESD): IEC 61000-4-2
- Radiated RF: IEC 61000-4-3
- Electrical Fast Transient (EFT) /Burst: IEC 61000-4-4
- Conducted RF: IEC 61000-4-6
- Power Frequency and Magnetic Field: IEC 61000-4-8

Emission

- Radiated RF: EN 61000-6-4: 2007, 30 MHz to 1000 MHz

APPLICATION CONSIDERATIONS
The proper selection and application of power generation products and components, including the related area of product safety, is the responsibility of the customer. Operating and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, lubrication requirements, loading supports, and other factors can materially affect the application and operating results of the products and components and the custo-mer should carefully review its requirements. Any technical advice or review furnished by Regal Beloit America, Inc. and/or its affilia-tes ("Regal") with respect to the use of products and components is given in good faith and without charge, and Regal assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

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CSM Style B shown with flange pump.

HOTflow®Heating System CSM

Hotstart's CSM HOTflow® heating system is a coolant preheater, developed to maintain optimal temperatures for diesel and gas engines in stationary land power applications.

c UL us LISTED

CE



CSM Style A shown with union pump.

HEAVY DUTY HEATING

The CSM features the most powerful pump (10 gpm flow) and most powerful heating element options (up to 12 kW) in the HOTflow lineup. The CSM's heating power in an energy efficient system is ideal for replacing costly convection-based heaters in large-engine installations up to 100 L displacement.

MULTIPLE CONFIGURATIONS

The CSM lineup is equipped to meet a wide array of conditions, including power source requirements and agency certifications. Whatever your power or heating needs, there's a CSM to meet your specific heating system application.

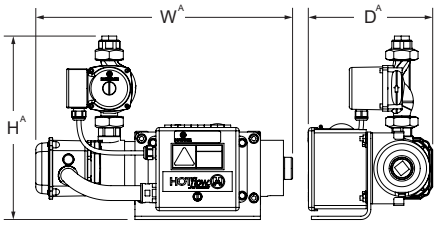
CONTROLS & AUTOMATION OPERATION

The CSM's control box allows for easy power connections and enables automatic heater operation, eliminating the need for additional customer-supplied control components.

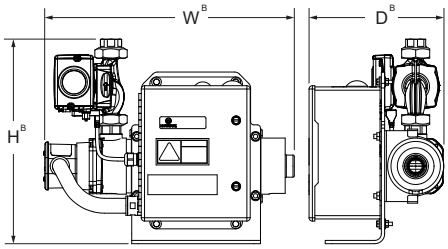
SINGLE HEATER SOLUTION

The CSM's power and pump-driven forced circulation provides superior heat distribution, making the CSM a viable option to replace paired or multiple convection-based heaters improving heating performance while reducing maintenance costs.

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CSM Style A shown with UL-recognized union pump. Dimensions may vary.



CSM Style B shown with CE-compliant union pump. Dimensions may vary.

Style A			
Height* (H^A)	Width (W^A)	Depth (D^A)	Weight
15.0"	19.4"	9.5"	37 lbs
383 mm	493 mm	242 mm	16.8 kg

Style B			
Height* (H^B)	Width (W^B)	Depth (D^B)	Weight
17.0"	19.4"	9.5"	54 lbs
434 mm	493 mm	242 mm	24.5 kg

* Height values are stated for flange connection pump. If union pump is installed, the model's height will decrease by approximately 1.5" (38 mm).

System	
Phase	single-phase (1 Ø) | three-phase (3 Ø)
Voltage (60 Hz)	120V | 208V | 240V | 440V | 480V | 575V
Voltage (50 Hz)	230V | 400V
Control Box Ingress	NEMA 4/IP66
Motor Ingress	NEMA 2 (UL-listed)/IP44 (CE-compliant)
Min./Max. Ambient Temp.	-4°F to 104°F (-20°C to 40°C)
Certification	UL/C-US listed models available (E250789) CE-compliant models available

Coolant	
Fluid Type	Water | Coolant mix (50% water/50% glycol)
Heat Power	3 kW | 6 kW | 9 kW | 10.5 kW | 12 kW
Temp. Control	Fixed, 100–120°F (38–49°C)
Pump Power	97 W (60 Hz)/70 W (50 Hz)
Flow	10 gpm @ 10 ft WC (37.9 L/min @ 3 m WC)
Max. Pressure	125 psi (860 kPa)
Pressure Loss	0.2 psi (1.5 kPa)
Inlet/Outlet	1" NPT

Ordering Information

CSM

Highlight Block Heater Used

Engine Displacement	Power Supply V	Ø	Hz	kW	Amps	Heating System Style	Model Number
1000–1500 CID 15–25 L	120	1	60	3	26.3	A	CSM10301-000
	208	1	60	3	15.1	A	CSM10308-000
	208	3	60	3	8.7	B	CSM30308-000
	230	1	50	3	13.7	A	**CSM1030J-5A0
	240	1	60	3	13.1	A	CSM10302-000
	400	3	50	3	4.9	B	**CSM3030A-5A0
	480	1	60	3	3.8	B	CSM10304-000
	480	3	60	3	4.4	B	CSM30304-000
1500–3000 CID 25–50 L	208	1	60	6	29.6	A	CSM10608-000
	208	3	60	6	17.1	B	CSM30608-000
	230	1	50	6	26.7	A	**CSM1060J-5A0
	240	1	60	6	25.6	A	CSM10602-000
	400	3	50	6	8.9	B	**CSM3060A-5A0
	440	3	60	6	8.1	B	**CSM3060F-5A1
	480	1	60	6	12.8	B	CSM10604-000
	480	3	60	6	7.4	B	CSM30604-000
	575	3	60	6	6.2	B	CSM30605-000
3000–4500 CID 50–75 L	208	1	60	9	44.0	A	CSM10908-000
	208	3	60	9	25.4	B	CSM30908-000
	230	1	50	9	39.8	A	**CSM1090J-5A0
	240	1	60	9	38.1	A	CSM10902-000
	400	3	50	9	13.2	B	**CSM3090A-5A0
	440	3	60	9	12.2	B	**CSM3090F-5A1
	480	1	60	9	19.1	B	CSM10904-000
	480	3	60	9	11.0	B	CSM30904-000
	575	3	60	9	9.2	B	CSM30905-000
4500–6000 CID 75–100 L	208	1	60	10.5	51.2	B	CSM11058-000
	208	3	60	12	33.7	B	CSM31208-000
	230	1	50	12	52.8	B	**CSM1120J-5A0
	240	1	60	12	50.6	B	CSM11202-000
	400	3	50	12	17.5	B	**CSM3120A-5A0
	440	3	60	12	15.9	B	**CSM3120F-5A2
	480	1	60	12	25.3	B	CSM11204-000
	480	3	60	12	14.6	B	CSM31204-000
	575	3	60	12	12.2	B	CSM31205-000

** – CE-compliant/union pump configuration

Other voltages available. Consult the factory.

Options shown represent typical tested or certified configurations.

MicroGenius2

Intelligent Battery Charger



Model	Power	12V Output	24V Output
MicroGenius 300	300 watts	12 amps	10 amps

Small. Powerful. Rugged.

- Patented Dynamic Boost™ Charge - safely recharges batteries faster than competing products
- HELIX™ technology - significantly increases battery life and cuts risk of sudden battery failure
- Field selectable 12/24 volt output - simplifies inventory management & field service
- Hardened switchmode powertrain - delivers first-class abuse resistance & state-of-the-art energy efficiency
- Small, lightweight, water resistant package - allows installation in nearly any location
- Standard J-1939 and Modbus communications - easily enable genset integration.
- Class-leading energy efficiency that saves money and exceeds energy efficiency regulation requirements.

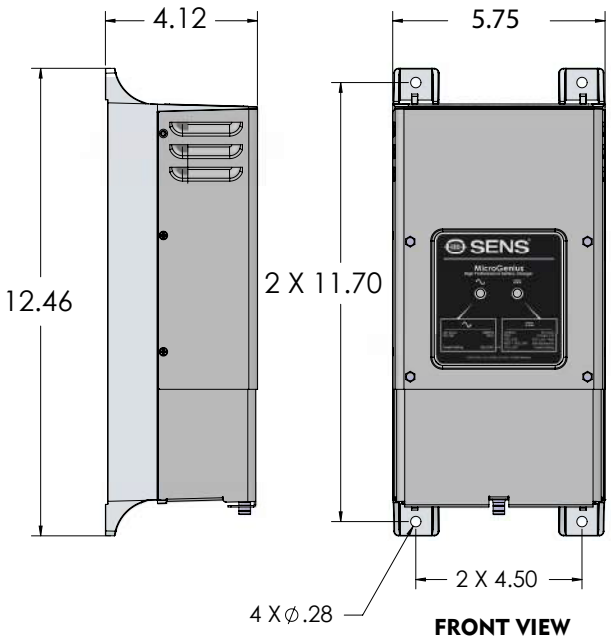
Specifications

AC Input	VAC, Hz	90-265 [1] VAC, 47-63 Hz
	Protection	Supplementary overcurrent protection fuse, transient protected to EN61000-4-5 level 4
	Efficiency	Up to 93%; meets CA Energy Commission Title 20 Appliance Efficiency Regulations; standby AC draw < 3W
	Power factor	>.95 typical
DC output	Voltage	12/24 V nominal, field selectable, adjustable from 0-34V using computer to charger cable [2]
	MicroGenius 180	Selectable 12/24 volt nom., 10/6 amps. 180W max.
	MicroGenius 300	Selectable 12/24 volt nom., 12/10 amps. 300W max.
	MicroGenius 450	Selectable 12/24 volt nom., 15/15* amps, 450W max. (*24V, 12A max below 170 VAC input voltage)
	Charging modes	Float voltage, boost voltage. Two additional HELIX charging voltages in flooded lead-acid battery program
	DC power supply operation	Delivers fast-responding, stable, well-filtered DC without battery
	Current limit	100% current capability subject to temperature limits shown on charts (previous page). Field adjustable
	Charging characteristic	Constant voltage, current limited; patented Dynamic Boost control
	Line & load regulation	±0.5%
	Output ripple	< 100 mV wideband
	Battery temp. compensation	Standard. Optional remote battery temperature probe [3]
	Output protection	Current limit, supplementary overcurrent protection fuse, transient protected
	Overvoltage protection	Self-resetting and selective (shutdown only operates if charger causes the overvoltage condition)
	Dead battery charge	Starts into, and recharges zero volt battery without user intervention
	Parallel operation	Two or more chargers operate with all modes synchronized for increased current or fault tolerance [4]
Adjustment & Controls	Charge mode control	Fully automatic patented Dynamic Boost system
	Internal adjustments	12 or 24-volt; Battery type program; fine voltage setting
	Battery type programs	Flooded lead-acid, AGM or Ni-Cd for engine starting; VRLA for reserve power; ultracapacitor
	Factory adjustment	All charger adjustments factory set to customer specifications. Field reconfigurable
	Field voltage adjustment	3 manually selectable voltage settings. Infinite adjustment using computer to charger cable [2]
	Computer adjustment	Change or customize settings from computer using computer to charger cable [2]
	Keypad adjustment	Enable or change all settings from front panel [5]
Status Display	LEDs	Two multi-color front panel status LEDs
	Digital metering	Voltmeter accurate to ±2%; ammeter to ±5% [6]
	Status messages	20-character display of status & alarm messages
Alarms	Alarms	Factory set and field reconfigurable. Standard genset configuration includes summary; AC fail; charger fail; high DC volts, low DC volts, low cranking volts. Other alarm conditions [7] are available to replace, or be summed with the standard values. Contact SENS to request different factory alarm profile.
	Alarm: Output via network	All alarms available via either J-1939 or Modbus ports
	Alarms: Form C contacts	Two Form C contacts, each rated 30V, 2A resistive, assignable [8]
	Alarm: Output via network	Five Form C contacts, each rated 30V, 2A resistive, assignable [9]
Networking	J-1939 communications	CAN 2.0 extended ID on RJ-45 port
	Modbus communications	Modbus RS-485 on RJ-45 port
	SENSbus	Proprietary bus for connection of paralleled chargers and future SENS accessories
Environmental	Operating temp: 180	-40C to +70C; meets full specification from -40C to +60C, natural convection cooled [10]
	Operating temp: 300	-40C to +70C; meets full specification from -40C to +50C, natural convection cooled
	Operating temp: 450	-40C to +70C; meets full specification from -40C to +40C, natural convection cooled
	Storage temperature	-40C to +85C
	Humidity	5% to 95%, non-condensing
	Water ingress	IP 22; NEMA 3R
	Vibration	Swept Sine (EN60068-2-6): 4G, 18-500 Hz, 3 primary axes. Random: 20-500Hz, .01G^2/Hz
	Shock	EN 60068-2-27 (15G)
	Electrical transient	ANSI/IEEE C62.41 & EN 61000-4-12 on power terminals
Abuse Protection	Reverse polarity	Charger self-protects without fuse clearing. Indication via LED & optional LCD
	Wrong voltage battery	Charger-battery voltage mismatch shuts down charger. Indication via LED & optional LCD
	Overtemp protection	Gradual output power reduction if heatsink temperature becomes excessive
Regulatory Compliance	North America	C-UL Listed for US & Canada: UL 1236 categories BBGQ, BBHH, BBJY and QWIR [11]; CSA 22.2, No. 107.2
		Certified to UL 1236 supplements SB (marine), SC (fire pump) and SE (emergency generator)
		NFPA-70, NFPA-110 [12]
		FCC Part 15, Class B
		Seismic: Rigid & non-structure wall mount; max S_{DS} of 2.5G. IBC 2000-2012, Calif. BC 2007-2010
		American Bureau of Shipping, type approved
	European Union (CE)	EMC: 2014/30/EU (EN 61000-6-2 & EN 61000-6-4)
		LVD: 2014/35/EU (EN 60335-1 & EN 60335-2-29)
		RoHS 2: 2011/65/EU (EN 50581)
Construction	Housing/configuration	Die-cast aluminum heatsink base with stainless steel covers & fasteners
	Dimensions & Weight	See drawings, dimensions & weight section on last page
	Weight	6.0 lbs; 2.7 Kg
	Connections	AC & DC terminal blocks: 14 to 10 AWG. J-1939 and Modbus-485: RJ-45. Form C alarms: 28 to 16 AWG

1 Output power derates below 100 VAC input; full 15A output of 450W available only above 170 VAC input 2 Requires optional computer to charger adapter SENS p/n 209254 plus free SENS software available at www.sens-usa.com 3 Remote battery temp sensor is optional. Order SENS p/n 209481 4 Requires standard RJ-45 network cable to connect paralleling bus. Order SENS p/n 208118-72 (72-inch length) or 208118-180 (180-inch length) 5 Requires that digit 12 of the model number be F 6 Requires that digit 12 of the model number be D, E, or F 7 Overvoltage shutdown, reverse polarity battery, incompatible battery, invalid settings, I/O bus inactive, thermal fold back, no temperature probe, current limiting, ground fault, low current 8 Models with E or G as digit 12 of the model number include 2 ea. Form C alarm contacts 9 Models with D or F as digit 12 of the model number include 5 ea. Form C alarm contacts 10 At 65 deg. C and above the LCD display may be unreadable and display life will be reduced 11 Except 180W unit in 24V configuration, which is not listed to QWIR 12 All chargers equipped with an alarm / display board meet NFPA-110 requirements. For chargers without an alarm / display board to meet NFPA-110, charger performance and alarm data available on the J-1939 port must be annunciated by the genset control panel.

Dimensions & Weight

All unit dimensions are identical.
All units weigh 6.0 lbs. (2.8 KG).
All dimensions are in inches.



FRONT VIEW
NO DISPLAY



FRONT VIEW WITH
OPTIONAL DISPLAY

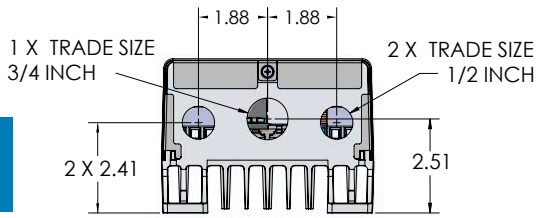


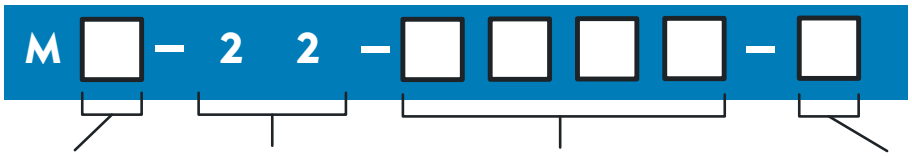
FRONT VIEW WITH OPTIONAL
DISPLAY AND OPTIONAL KEYPAD

How To Order

Battery Charger Info

Use the Model Number Breakout below to configure your charger:





Power
1= 180w
3= 300w
4= 450w

Output Voltage
22 = 12/24V

Output Current
1006 = 10A @ 12V; 6A @ 24V (180 only)
1210 = 12A @ 12V; 10A @ 24V (300 only)
1515 = 15A @ 12V; 15A @ 24V (450 only)

Alarm & Communication Options
A = base model; includes J-1939 & Modbus communications
D = base model + LCD display + 5 ea. Form C alarm relays
E = base model + LCD display + 2 ea. Form C alarm relays
F = base model + LCD display + 5 ea. Form C alarm relays + keypad control

Example: M3-22-1210-F

Keep your heavy-duty equipment operating with Deka Commercial Batteries.



Keep Heavy-Duty Equipment Running at Top Performance

Demanding commercial equipment requires nothing less than the most powerful, reliable batteries. This complete line of the toughest commercial product is specially engineered for durability while meeting high power ratings for heavy-duty engines.

Key Features and Benefits of the Deka Commercial Line

- Genuine calcium lead alloy provides longer waterless operation and extended battery life.
- Anchor-locked elements with full-frame grids and tight-packed commercial plates resist the damaging effects of vibration, delivering more power-per-pound than other batteries.
- Most of our commercial batteries contain premium "deep pocket" envelope separators, which protect the plates on all four sides to dramatically reduce shorting and extend service life.
- Special computer-aided design and manufacturing means more durability for heavy-duty generators.



- Deka Commercial Batteries are available wet and some can be ordered bone-dry. Our special dry-charge process completely eliminates moisture for virtually unlimited shelf life when compared to inferior "moist-dry" types.
- Most popular sizes feature tough polypropylene cases which resist breakage and extend service life. Many are also available with handles and special terminals for easy installation.
- Deka offers the most complete line of enveloped calcium maintenance-free commercial batteries in the industry. Our line includes such hard-to-find group sizes as 5D.
- More than 250 quality control checks ensure the highest quality.

Commercial Batteries

Highlight Battery Used

GROUP NO.	PART NO.	PERFORMANCE LEVEL			WEIGHT (LB.)	MAXIMUM OVERALL DIMENSIONS						CORE VALUE	FOOTNOTES
						LENGTH		WIDTH		HEIGHT			
		CCA	RC	REF. CA		in	mm	in	mm	in	mm		
8-VOLT COMMERCIAL SERVICE													
1	801	520	102	640	32	8-7/8	225	6-3/4	171	8-7/8	225	1.0	12,25
6-VOLT HEAVY-DUTY COMMERCIAL SERVICE													
1	901MF	640	130	785	33	9	229	6-7/8	175	8-3/4	222	1.0	21,25
2	902	675	185	830	37	10-3/8	264	6-7/8	175	8-3/4	222	1.0	12,25
3EH	93EH	875	250	1075	47	19-1/4	489	4-1/4	108	10	254	1.0	12,25
4	904MF	975	250	1200	48	12-1/2	318	6-7/8	175	9-1/2	241	1.5	21,25
5D	905D	880	250	1080	50	13-3/8	340	7-1/8	181	9-1/4	235	1.5	12,25
12-VOLT HEAVY-DUTY COMMERCIAL SERVICE													
3ET	93ET	500	120	615	49.5	19-1/4	489	4-1/4	108	9-7/8	251	1.0	12,25
4D	904D	1050	290	1290	97	20-3/4	527	8-1/2	216	10-1/8	258	3.0	12,17,21,22
4DLT	94DLT	850	240	1045	78.5	20	508	8-1/8	206	8-1/8	206	2.0	12,19,25
8D	908DFT	1425	440	1755	127	20-3/4	527	11	279	10	25	4.0	12,17,21,22
	908D	1400	430	1720	130							4.0	12,17,25
	708D	1100	325	1355	114.5							4.0	12,17,25
17TF	917TF	530	140	650	63	17	432	6-7/8	175	8	203	1.5	11,15,19,25
28	928MF	550	100	675	42.5	10-1/4	260	6-3/4	171	9-1/2	241	1.0	21,22,X
30H	930H	650	150	800	51	13	330	6-3/4	171	9-1/2	241	1.5	19,21,22
31	1231MF	1000	185	1230	60	13	330	6-3/4	171	9-1/2	241	1.5	17,19,21,22,X
	1131MF	950	175	1170	56.5							1.5	17,19,21,22,X
	1031MF	760	170	935	53.5							1.5	17,19,21,22,X
	931MF	650	150	800	52							1.5	17,19,21,22,X
31P	1231PMF	1000	185	1230	60	13	330	6-3/4	171	9-1/2	241	1.5	17,19,21,22
	1131PMF	950	175	1170	56.5							1.5	17,19,21,22
	1031PMF	760	170	935	53.5							1.5	17,19,21,22
	931PMF	650	150	800	52							1.5	17,19,21,22
12-VOLT HEAVY-DUTY COMMERCIAL SEVERE SERVICE/DUAL PURPOSE													
31	7T31	730	190	900	62	13	330	6-3/4	171	9-1/2	241	1.5	17,19,21,22,X
31P	7T31P	730	190	900	62							1.5	17,19,21,22
31	DP31CS	700	185	860	57							1.5	17,19,21,22,X
12-VOLT DRY CHARGED - HEAVY-DUTY COMMERCIAL SERVICE (Acid Sold Separately)													
8D	908DY	1400	430	1720	80	20-3/4	527	11	279	10	254	4.0	12,17,23,25
31	1231MFD	1000	185	1230	43	13	330	6-3/4	171	9-1/2	241	1.5	17,19,21,22,23,X

- Batteries are maintenance-free calcium grids, except where noted
- Batteries manufactured in polypropylene cases and covers, except where noted
- Batteries manufactured in black cases & covers
- Terminals are SAE Posts, unless otherwise noted
- Weights are approximate
- CA @ 32°F are approximations and for comparison only
- CCA and RC ratings conform to B.C.I. specifications

FOOTNOTES:

X - 3/8" x 16 stainless steel stud posts
11 - Low maintenance – Low antimony grids
12 - Hybrid construction
15 - Hard rubber, one-piece cover construction
17 - Includes handle
19 - Includes lifting ledges
21 - Anchor lock elements
22 - Flush manifold vented cover
23 - Up to 10% reduced capacity
25 - With individual vent caps

PROPOSITION 65 WARNING: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Batteries also contain other chemicals known to the State of California to cause cancer. WASH HANDS AFTER HANDLING.

MEMBER:

ATA AMERICAN TRUCKING ASSOCIATION

TMC TECHNOLOGY & MAINTENANCE COUNCIL

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Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-352-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Consideration of Mutual Aid Agreement for the Town of Garner and Wake Forest

Recommendation:

Item Summary:

ATTACHMENTS
- MUTUAL AID AGREEMENT FOR GARNER AND WAKE FOREST.docx

MUTUAL AID AGREEMENT FOR STORM CLEANUP BETWEEN THE TOWNS OF WAKE FOREST AND GARNER

This Mutual Aid Agreement ("Agreement") is entered into as of December 14, 2023, by and between the Town of Garner, a North Carolina municipality and the Town of Wake Forest, a North Carolina municipality, collectively referred to as the "Participating Municipalities."

RECITALS:

WHEREAS, the Participating Municipalities recognize the potential for severe storms and natural disasters that may result in damage to public infrastructure, private property, and public safety within their respective jurisdictions;

WHEREAS, the Participating Municipalities desire to establish a mutual aid agreement pursuant to NCGS §166A-19.72 to facilitate the sharing of resources and assistance in the event of a storm or natural disaster, with a primary focus on efficient and effective cleanup efforts;

NOW, THEREFORE, in consideration of the mutual covenants contained herein and other good and valuable consideration, the Participating Municipalities agree as follows:

ARTICLE 1: PURPOSE

The purpose of this Agreement is to provide a framework for cooperation and mutual assistance among the Participating Municipalities in the aftermath of a storm or natural disaster, specifically for the cleanup of debris, restoration of public infrastructure, and support for affected residents.

ARTICLE 2: DEFINITIONS

2.1 "Emergency" shall mean an occurrence or imminent threat of widespread or severe damage, injury, or loss of life or property resulting from any natural or man-made accidental, military, paramilitary, terrorism, weather-related, public health, explosion-related, riot-related cause, or technological failure or accident, including, but not limited to, a cyber incident, an explosion, a transportation accident, a radiological accident, or a chemical or other hazardous material incident.

2.2 "Resources" shall include personnel, equipment, supplies, and other assets that may be made available by a Participating Municipality to assist another.

ARTICLE 3: MUTUAL AID

3.1 Activation of Mutual Aid:
In the event of an emergency, the affected Participating Municipality may request assistance from other Participating Municipalities through their designated emergency management contacts.

3.2 Provision of Resources:
The Participating Municipalities agree to make available, to the extent possible, resources necessary for storm cleanup and recovery, in accordance with the requests made by the affected municipality.

ARTICLE 4: RESPONSIBILITIES

4.1 Requesting Municipality:

The requesting municipality shall provide clear and timely information regarding the type and scope of assistance needed, and shall coordinate the deployment and utilization of resources received.

4.2 Assisting Municipality:
The assisting municipality shall make every effort to provide the requested resources promptly and efficiently, taking into consideration the needs and priorities of the requesting municipality.

ARTICLE 5: REIMBURSEMENT

The Participating Municipalities agree to negotiate in good faith any necessary reimbursement for expenses incurred during mutual aid activities, recognizing the financial constraints that may be faced by assisting municipalities.

ARTICLE 6: TERMINATION

This Agreement may be terminated by any Participating Municipality upon written notice to the other Participating Municipalities. Termination shall be effective immediately upon receipt of such notice.

ARTICLE 7: GOVERNING LAW

This Agreement shall be governed by and construed in accordance with the laws of the State of North Carolina.

IN WITNESS WHEREOF, the duly authorized representatives of the Participating Municipalities have executed this Agreement as of the Effective Date.

TOWN OF WAKE FOREST

_____
Vivian Jones, Mayor

Attest:

_____

TOWN OF GARNER

_____
Buddy Gupton, Mayor

Attest:

_____

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-67-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Department Monthly Report

Recommendation:

Item Summary:

ATTACHMENTS
- November 2023 Monthly Report Draft.pdf

November 2023 | Department Monthly Report

TOWN of WAKE FOREST

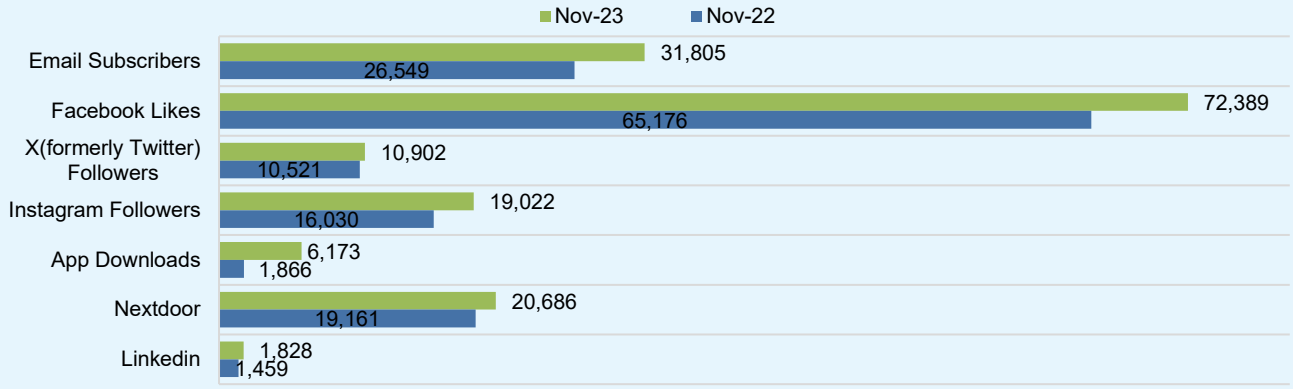
Communications

ANNOUNCEMENTS	
Media Releases	35
Email Announcements	18
Town-to-Resident Phone Calls/Texts	0

TOP 5 VIEWED PAGES ON WEBSITE

RANK	PAGE	VIEWS
1	Customer Service Forms & Applications	15,432
2	Home	8,163
3	Utility Bill Payment Options	3,031
4	Tis the Season	2,898
5	Voter Election Info	2,570

SUBSCRIBERS



Downtown Development

OCCUPANCY

	OCT – DEC 2023	OCT – DEC 2022
Occupancy Rate in Percentage	93%	90%

NEW BUSINESSES

	NOVEMBER 2023	FISCAL YEAR-TO-DATE
Number of New Businesses	2	4
Number of Businesses Closed	1	2

EVENTS

FOURTH QUARTER EVENTS (OCT-DEC)	ATTENDANCE IN 2022	ATTENDANCE IN 2023
WF Cares Holiday Kickoff	6000	6500

UPDATES PROVIDED QUARTERLY

Wake Forest Cares Holiday Kickoff was a success. The community performance stage continues to be a hit with over 11 local groups/entities performing throughout the day. Over $1000 was raised for the WF Cares initiatives at the event.

A merchant social was held at The Makery this past month with over 12 different businesses in attendance.

Broadsides & Brews opened this past month after acquiring the property over a year ago and spending time to upfit to meet their needs. Another business expansion occurred this month with The Burger Shop taking over the space vacated by The Lemon Tree and opening The Soup and Salad Shop. This provides an additional food option in downtown and has been well received. We are seeing more creative use of space and a perfect example of this is the opening of The Yellow Butterfly (gift boutique), which is sharing space with Heritage Floral Design. The Listening Room also returned to Downtown this month after an almost two-year hiatus and is now offering performances in the expanded space at Page 158 Books.

Downtown Development Director, Jennifer Herbert, earned her Historic Real Estate Development Finance Professional Certification.

Economic Development

WFBIP MONTHLY NEWSLETTER VIEW

The Wake Forest Business & Industry Partnership's Quarterly Report is updated at the end of each quarter.

Use Chrome, Firefox, Safari, or Edge to view the newsletter and/or the report.

REQUESTS FOR INFORMATION (RFIs)

	NOVEMBER 2023	NOVEMBER 2022
Number of Responses to RFIs	0	0

BUSINESS RETENTION & EXPANSION

NAMES OF BUSINESSES VISITED THIS MONTH
Capital Properties NC
Fidelity Bank

Engineering

Stormwater Infrastructure	The Board of Commissioners approved the stormwater infrastructure fee in November of 2023. Staff will now work on the administrative manual to develop internal procedures.
Resurfacing Project:	The contract has been awarded to Fred Smith and the contract management awarded to Mott MacDonald.

Finance

FINANCIAL TASKS COMPLETED

TAX RETURNS & REPORTS	COMPLETION DATE
NC Sales and Use Tax Form E500 and payment	11/14/23
ORBIT/LGERS Report – NC State Treasurer	11/1/23
Utility Sales Tax Return – E500 E	11/14/23
BLS Department of Labor Report	11/28/23
Food & Beverage Tax Report	11/3/23
ACCOUNTING/FINANCE	**AMOUNT**
Total $ Accounts Payable Disbursement	$3,806,558
Total ePayables & Payroll Disbursement	$1,430,042
Total Number of Invoices Paid	669
Total $ Invoices Paid with credit card	$753,553
FY22-23 AUDIT	**COMPLETION DATE**
FYE June 30, 2023, Financial Report presented to BOC	11/21/23

PURCHASING / WAREHOUSE

Purchase Orders Processed	50
New Vendors Set Up	11
Informal Quotes	17
$ Received Surplus Items Sold	$91,012
HUBSCO	0

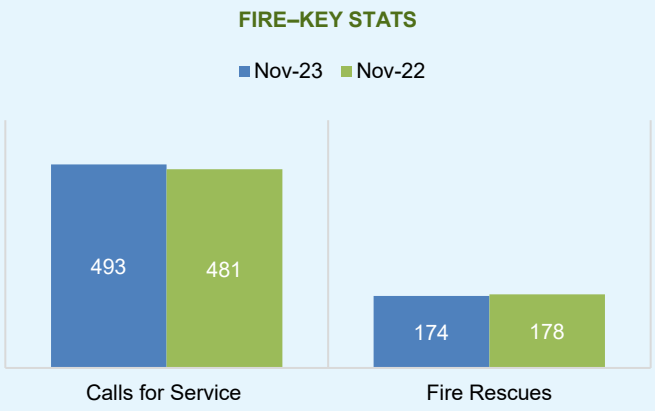
Fire

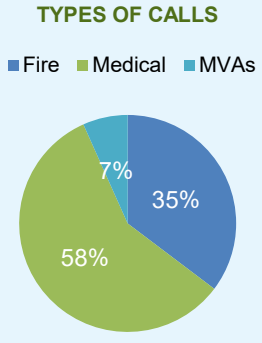
KEY STATS

	NOVEMBER 2023	NOVEMBER 2022
Calls for Service	493	481
Average Response Time	4:25	4:18

TYPES OF CALLS

	NOVEMBER 2023	NOVEMBER 2022
Fire	174	178
Medical	286	273
Motor Vehicle Accidents (MVA)	33	30





Human Resources

EMPLOYEE NAME	DEPARTMENT	POSITION	DATE
Adam Smith	Public Works	Solid Waste Equipment Operator	10.30.23

EMPLOYMENT		
As of NOVEMBER 30, 2023	NOVEMBER 2023	NOVEMBER 2022
Positions Filled	402	377
Vacancies	38	34
Total Authorized Positions FY 2023-2024	**440**	**411**

Information Technology

SERVICE STATS		
	NOVEMBER 2023	NOVEMBER 2022
Service Requests Completed	435	362
Network Uptime Percentage	99%	100%

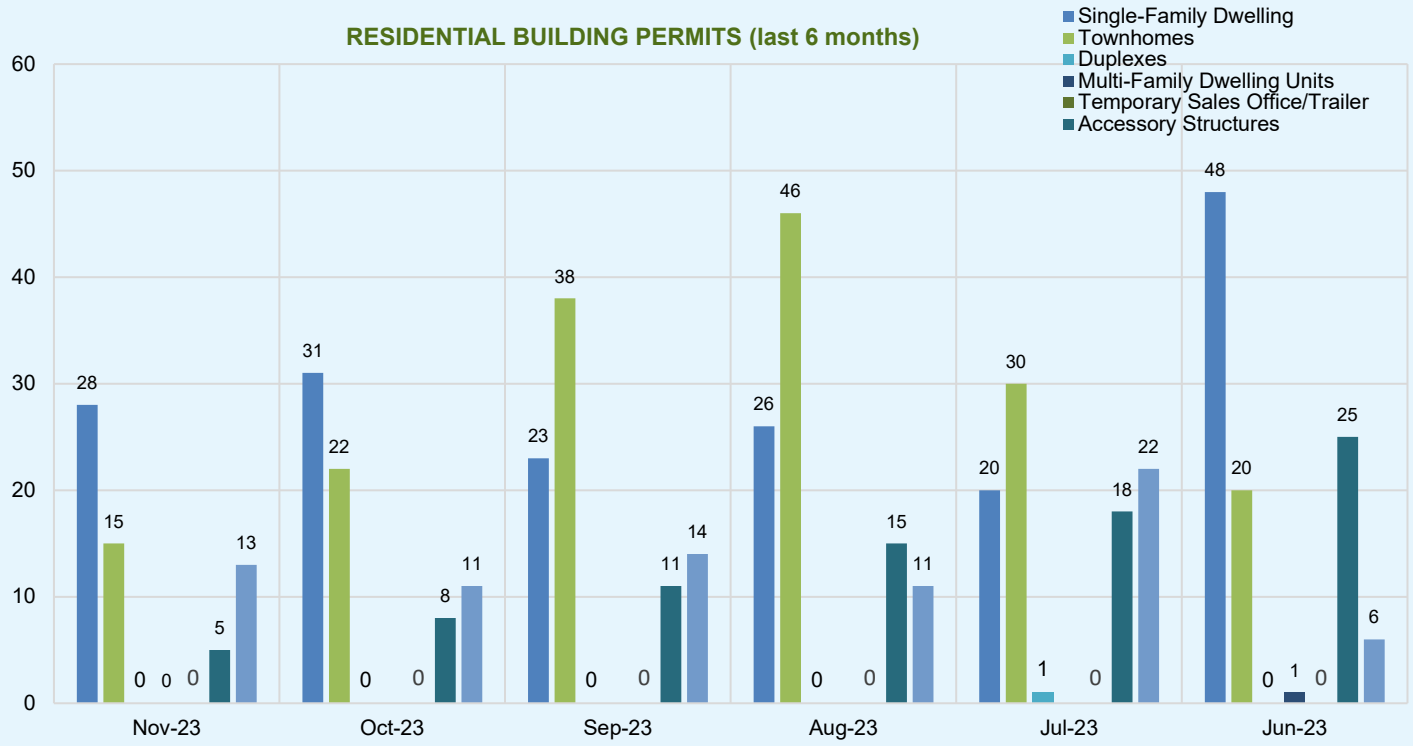
Inspections & Public Facilities

RESIDENTIAL PERMITS

	NOVEMBER 2023	NOVEMBER 2022
Single-Family Dwelling	28	22
Townhomes	15	21
Duplexes	0	0
Multi-Family Dwelling Units	0	0
Other	87	109
Total	**130**	**152**

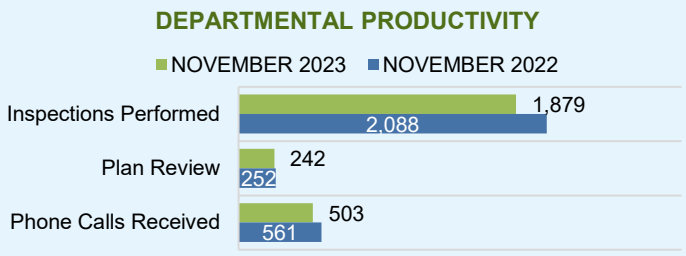
NON-RESIDENTIAL PERMITS

	NOVEMBER 2023	NOVEMBER 2022
New Commercial	0	0
Fit-Ups	5	0
Other	34	26
Total	**39**	**26**



PUBLIC FACILITIES

	NOVEMBER 2023	NOVEMBER 2022
Preventative Maintenance Completed	528	1,341
Reactive Work Orders	78	347



BUSINESSES	
NEW COMMERCIAL BUSINESSES	ADDRESS
FIT-UPS	
HAPPY HEALING	744 MERRITT CAPITAL DR 104
WELLS FAMILY DENTAL	911 GATEWAY COMMONS DR 104
TAZA GRILL	1898 S FRANKLIN ST 110
SOO CAFE	12281 CAPITAL BLVD
SUPER HOMES SERVICES (lawn care)	741 MERRITT CAPITAL DR 113
PRE-OCCUPANCIES	
THE MAKERY	317 E ROOSEVELT AVE
WAKE FOREST NATURAL HAIR SALON	10520 LIGON MILL RD 116
VISIBLE MOTORSPORTS LLC	745 MERRITT CAPITAL DR 105

Organizational Performance

NORTHERN WAKE FOOD SECURITY TEAM	
Staff Hours	Avg. 12 hrs./week
Updates	Mobile Market, Holiday Food Drive

GUEST SERVICES VOLUNTEER (GSV) PROGRAM	
Updates	13 in the program – 7 new applicants (3 onboarding)

Parks, Recreation & Cultural Resources

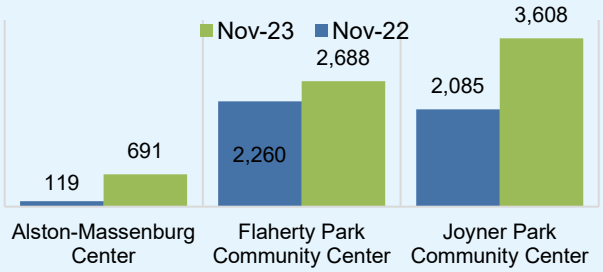
ATHLETICS

	NOVEMBER 2023	NOVEMBER 2022
Registrations Received – Youth	1	0
Registrations Received – Adult	0	0
Games Held	0	0
Revenue	75.00	0

PROGRAMS

	NOVEMBER 2023	NOVEMBER 2022
Registrations Received – Youth	100	89
Registrations Received – Adult	115	135
Classes/Programs Held	30	33
Revenue	$5,058	$4,896

VISITORS TO COMMUNITY CENTERS



RECCONNECT PROGRAM GUIDE VIEW

The program guide is updated twice per year in January and July.

PARK MAINTENANCE

TYPE OF MAINTENANCE	QUANTITY
Vandalism	2
Reactive Maintenance	2
PM Inspections and services	73
Evening and Weekend Park Services	4

FACILITY RENTALS

	NOVEMBER 2023	NOVEMBER2022
Athletic Fields	3	27
Joyner Park Outdoor / Open Space	5	5
General Outdoor / Open Space	2	2
Picnic Shelters	3	1
Wake Forest Community House	9	6
Joyner Park Community Center	4	2
Flaherty Park Community Center	0	0
Alston-Massenburg Community Center	2	0

VISITORS TO AQUATIC CENTER & SPRAYGROUND

	NOVEMBER 2023	NOVEMBER 2022
Aquatic Center	CLOSED	CLOSED
Taylor Street Sprayground	CLOSED	CLOSED

Planning

DEVELOPMENT SERVICES MONTHLY REPORT VIEW

ZONING VIOLATIONS DASHBOARD VIEW

Use Chrome, Firefox, Safari, or Edge when viewing the dashboard.

CERTIFICATES OF APPROPRIATENESS

	NOVEMBER 2023	NOVEMBER 2022
COAs Received	1	0
COAs Approved	1	0

Police

KEY STATS		
	NOVEMBER 2023	NOVEMBER 2022
Calls for Service	4,480	4,604
Vehicle Crashes	188	191

Public Works

Streets:

- Drainage Ditch at Joyner Park
- Roadside cleanup
- Hauled and stock-piled dirt for the Flaherty Pond Dam Project
- Alston Massenburg Historic signs
- LTAP Training- Pavement Preservation (J. Medlin, A. Carroll, Seth Huntsinger) Work Zone Supervisor (J. Carpenter, D. Carroll)
- Assisted with Wake Forest Cares, Gobble Run, and Turkey giveaway
- Poured S. Franklin Islands
- Hearing Test
- 36 Tons of Asphalt repairs

Solid Waste:

- Jeanette Johnson hosted her second educational workshop this month, this workshop featured Recycling Right.
- Due to the increase in recycling contamination, we have restarted the recycle right campaign.
- Eric Williams started as a Solid Waste Collector
- Loose leaf pick-up has been smooth and consistent this month, with many, many leaves.

Urban Forestry:

- Ground 124 stumps
- Assisted SW with loose leaf collection
- Removed 54 trees

Fleet:

- Completed 186 work orders in November for a combined shop productivity average of 89% of billable hours.
- The 4 mechanics completed 13.5 combined hours of training.

RECYCLING		
	NOVEMBER 2023	NOVEMBER 2022
Volunteer Collected Litter	250	175
Volunteer Collected Recycling	250	0
Volunteer Hours	131	31
Volunteer Miles of Streets	2	1
Sections of Roads Cleaned (not miles)	2	0
Number of Creeks Cleaned	0	2
Number of Litter Kits Issued/Returned	58	28

SOLID WASTE		
	NOVEMBER 2023	NOVEMBER 2022
New Construction Homes Added	92	42
New Cart Sets	92	42

CEMETERY		
	NOVEMBER 2023	NOVEMBER 2022
Number of Plots Sold	0	4
Number of Niches Sold	1	0
Total Plots Available	0	33

Renaissance Centre for the Arts

EVENT & PROGRAM ATTENDANCE

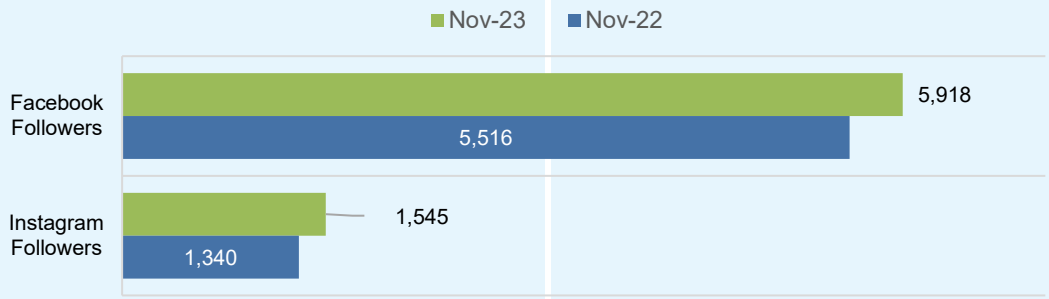
	NOVEMBER 2023	NOVEMBER 2022
Monthly In-Person Attendance	1,052	806
Virtual Views	361	404
Ticketed Events Held	1	1
Free Events Held	0	1

RENAISSANCE CENTRE PROGRAM GUIDE

VIEW

- The Renaissance Centre celebrated its 10th Anniversary on November 18th with a Gala featuring saxophonist Marcus Anderson. The SOLD-OUT event was a huge success. As a part of the evening's festivities, the Public Art Commission unveiled a sculpture commemorating the historic milestone. "Bravo" will remain on permanent display in the Centre lobby. Thank you, Ting Internet, for providing the funding for the sculpture.
- On November 2nd, the Renaissance Centre was the host venue for the Veterans Day Quilts of Valor presentation. Handmade quilts were presented to service members or Veterans who have been touched by war. Bluegrass group Nu Blu performed as a part of the celebration.
- The Renaissance Centre partnered with Pour Bar Services to host the Wake Forest Chamber of Commerce's November Business After Hours. 100 area business leaders attended the event.
- Four of the Renaissance Centre Staff attended the North Carolina Presenter Consortium's Arts Market. Professional development includes artist showcases and networking with industry professionals from across North Carolina and beyond.

SOCIAL ENGAGEMENT



Wake Forest Power

CUSTOMER SUMMARY

	NOVEMBER 2023	NOVEMBER 2022
Electric Meters/Customers	7,633	6,875
Pre-Pay Power Customers	472	468
H.O.P.E. Participants	44	46
N.C. GreenPower Participants	16	17

POWER OUTAGES

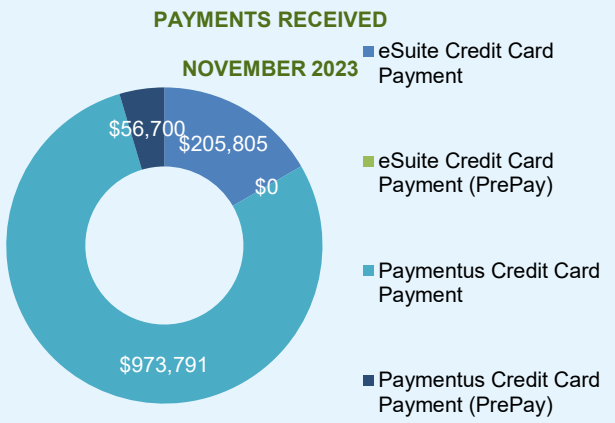
	NOVEMBER 2023	NOVEMBER 2022
Total Number of Customers Affected by Outages this Month	352	1,007
Average Number of Customers Affected per Outage	352	143.86

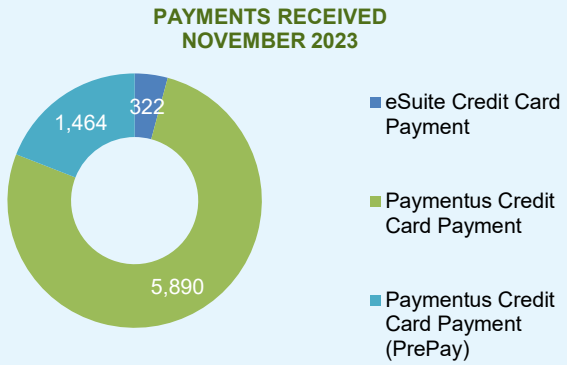
PAYMENTS RECEIVED

	NOVEMBER 2023	NOVEMBER 2022
eSuite Credit Card Payments	$205,805	$193,410
eSuite Credit Card Payments (Pre-Pay)	$0	$2,021
Paymentus CC Payments	$973,791	$612,232
Paymentus CC Payments (Pre-Pay)	$56,700	$45,115

NUMBER OF TRANSACTIONS

	NOVEMBER 2023	NOVEMBER 2022
eSuite Credit Card Payments	322	450
Paymentus CC Payments	5,890	4,418
Paymentus CC Payments (Pre-Pay)	1,464	1,283





Historic Preservation Commission

MEETINGS	
Most recent meeting held	11/08/2023
Number of members in attendance 6 out of 9	

The HPC approved two historical markers for Friendship Chapel Baptist Church and W.E.B. DuBois High School. Staff facilitated workshop with the HPC to provide feedback on the downtown plan.

Human Relations Council

MEETINGS	
Most recent meeting held	11/23/2023
Number of members in attendance 4 out of 8	

UPDATE:
Board members met to begin discussions about Comm-"Unity" Days and possible plans for a Minority-Owned Business Expo in March 2024.

Public Art Commission

MEETINGS	
Most recent meeting held	10/26/2023
Number of members in attendance 0 out of 10	

no meeting in November due to Thanksgiving. Next meeting Thursday, December 7.

Parks, Recreation & Cultural Resources Advisory Board

MEETINGS	
Most recent meeting held	11/27/2023
Number of members in attendance	9 out of 10

The regular monthly meeting was held on Nov. 27th at 6:30 pm at Town Hall. Before the meeting, the board held its annual potluck dinner. Members were reminded to sign up to volunteer for the events listed below.
Special Events - Volunteer Sign-up Genius: Chair Danny Hupp thanked the board for attending the staff luncheon; Volunteer opportunities:
* Master Plan Input Session /Lighting of Wake Forest Friday, Dec.1, 5 pm-8 pm,
* Calls from Santa Dec. 7
* Snowball Dance Dec. 8
* Interpretative Panels Dedication Ceremony Wed, Dec. 13, 4 pm @ Taylor Street Park.

Technology Advisory Board

MEETINGS	
Most recent meeting held	11/27/2023
Number of members in attendance 12 out of 13	

The latest update from TAB brings exciting news as two new members have been warmly welcomed to the board, injecting fresh perspectives and diverse expertise into the team. In addition to these new additions, TAB has kicked off its preparations for the much-anticipated STEM event scheduled for April. The formation of dedicated sub-committees marks a proactive approach to ensure the success and seamless execution of the event, showcasing the commitment of TAB to fostering innovation and excellence in the fields of science, technology, engineering, and mathematics.

Despite the bustling activity within the organization, it's worth noting that TAB has decided not to convene a meeting in December. This decision aligns with the recognition of the holiday season and provides an opportunity for members to engage in festive celebrations and recharge for the upcoming year.

Urban Forestry Board

MEETINGS	
Most recent meeting held	11/28/2023
Number of members in attendance 9 out of 9	

The board elected a new member chair and said goodbye to longtime board member Ira. The town has received American chestnut seedlings.

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-68-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Wake County Tax Release

Recommendation:

Item Summary:

ATTACHMENTS
- WF-TXREP-DEC-2023-BOC-MTG.pdf

WAKE COUNTY
NORTH CAROLINA

Board of Commissioners
P.O. Box 550 • Raleigh, NC 27602

TEL 919 856 6180
FAX 919 856 5699

SHINICA THOMAS, CHAIR
SUSAN EVANS, VICE-CHAIR
VICKIE ADAMSON
MATT CALABRIA
DON MIAL
CHERYL STALLINGS
JAMES WEST

December 5, 2023

Mr. Kip Padgett
Town Manager;
Town of Wake Forest
301 S. Brooks Street
Wake Forest, North Carolina 27587

Dear Mr. Padgett:

The Wake County Board of Commissioners, in regular session on December 4, 2023, approved and accepted the enclosed tax report for the Town of Wake Forest.

The attached adopted actions are submitted for your review; no local board action is required.

Sincerely,

Yvonne Gilyard
Clerk to the Board
Wake County Board of Commissioners

WAKE COUNTY

WAKE COUNTY TAX ADMINSTRATION
Rebate details
10/1/2023 - 10/31/2023

DATE	TIME	PAGE
11/01/2023	10:18:24 PM	1

WAKE FOREST

REBATE NUMBER	PROPERTY	SPEC DIST	CITY TAG	LATE LIST	BILLED INT	TOTAL REBATED	PROCESS DATE	ACCOUNT NUMBER	TAX YEAR	YEAR FOR	BILLING TYPE	OWNER
WAKE FOREST (Not In District)												
BUSINESS ACCOUNTS												
861847	1,023.34	0.00	0.00	0.00	0.00	1,023.34	10/25/2023	0006941204	2023	2023	000000	B & D INTEGRATED HEALTH SERVICES
860058	43.75	0.00	0.00	4.37	0.00	48.12	10/04/2023	0006983483	2023	2023	000000	QUINTO FAMILY INC
861605	0.15	0.00	0.00	0.02	0.00	0.17	10/21/2023	0006477121	2008	2008	000000	WAKE FOREST TANNING, INC.
Subtotal for BUSINESS ACCOUNTS	**1,067.24**	**0.00**	**0.00**	**4.39**	**0.00**	**1,071.63**		**3 Properties Rebated**				
BUSINESS REAL ESTATE ACCOUNTS												
861112	580.67	0.00	0.00	0.00	0.00	580.67	10/17/2023	0000307850	2023	2023	000000	FRANKLIN VILLAGE LLC
Subtotal for BUSINESS REAL ESTATE ACCOUNTS	**580.67**	**0.00**	**0.00**	**0.00**	**0.00**	**580.67**		**1 Properties Rebated**				
INDIVIDUAL REAL ESTATE ACCOUNTS												
860987	227.25	0.00	0.00	0.00	0.00	227.25	10/13/2023	0000428844	2023	2023	000000	SMITH, CALVIN
Subtotal for INDIVIDUAL REAL ESTATE ACCOUNTS	**227.25**	**0.00**	**0.00**	**0.00**	**0.00**	**227.25**		**1 Properties Rebated**				
WILDLIFE BOAT ACCOUNTS												
860828	363.31	0.00	0.00	36.33	0.00	399.64	10/12/2023	0004210356	2022	2022	000000	GRUEBEL, TIMOTHY

WAKE COUNTY

WAKE COUNTY TAX ADMINSTRATION
Rebate details
10/1/2023 - 10/31/2023

DATE	TIME	PAGE
11/01/2023	10:18:24 PM	2

WAKE FOREST

REBATE NUMBER	PROPERTY	SPEC DIST	CITY TAG	LATE LIST	BILLED INT	TOTAL REBATED	PROCESS DATE	ACCOUNT NUMBER	TAX YEAR	YEAR FOR	BILLING TYPE	OWNER
860320	40.92	0.00	0.00	4.09	0.00	45.01	10/06/2023	0004204657	2023	2023	000000	HOBGOOD, WILLIAM HOWARD JR
Subtotal for WILDLIFE BOAT ACCOUNTS	**404.23**	**0.00**	**0.00**	**40.42**	**0.00**	**444.65**		**2 Properties Rebated**				
TOTAL WAKE FOREST (Not In District)	**2,279.39**	**0.00**	**0.00**	**44.81**	**0.00**	**2,324.20**		**7 Properties Rebated for the District/City**				
TOTAL FOR CITY WAKE FOREST	**2,279.39**	**0.00**	**0.00**	**44.81**	**0.00**	**2,324.20**		**7 Properties Rebated for the City**				

WAKE COUNTY

WAKE COUNTY TAX ADMINSTRATION
Rebate details
10/1/2023 - 10/31/2023

DATE	TIME	PAGE
11/01/2023	10:18:24 PM	1

WAKE FOREST

REBATE NUMBER	PROPERTY	SPEC DIST	CITY TAG	LATE LIST	BILLED INT	TOTAL REBATED	PROCESS DATE	ACCOUNT NUMBER	TAX YEAR	YEAR FOR	BILLING TYPE	OWNER
Grand Total:	**5,777.98**	**0.00**	**60.00**	**213.52**	**0.00**	**6,051.50**	**32**	**Properties Rebated for All Cities**				

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-69-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Commissioner Reports

Recommendation:

Item Summary:

ATTACHMENTS

-

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-335-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Resolutions of Appreciation for Outgoing Commissioners

Recommendation:

Item Summary:

ATTACHMENTS

- Resolution2023-76_AppreciationOfServicesForChadSary_Dec202319.pdf
- Resolution2023-77_AppreciationOfServicesForJamesDyer_Dec202319.pdf

RESOLUTION 2023-76

RESOLUTION OF APPRECIATION FOR THE SERVICES OF CHAD SARY

WHEREAS, Chad Sary served the Town of Wake Forest and its citizens as a Commissioner since December 2019; and

WHEREAS, Mr. Sary served as ex-officio on the Town of Wake Forest Public Art Commission and served on the Central Pines Regional Council formerly known as Triangle J Council of Government (TJCOG); and

WHEREAS, Mr. Sary diligently and forthrightly worked to make the Town of Wake Forest a better place by carrying out his civic duties; and

WHEREAS, the Town of Wake Forest, its elected officials, employees, and its citizens individually and collectively commend Mr. Sary for his service to the Town of Wake Forest.

NOW, THEREFORE, BE IT HEREBY RESOLVED by The Honorable Mayor and Board of Commissioners of the Town of Wake Forest that this **Resolution of Appreciation** be presented to Chad Sary in acknowledgment of his service and his interest in good government in Wake Forest and the State of North Carolina.

Duly adopted this 19th day of December 2023.

(ATTEST) Vivian A. Jones, Mayor

Theresa Savary, Town Clerk

RESOLUTION 2023-77

RESOLUTION OF APPRECIATION FOR THE SERVICES OF JAMES DYER

WHEREAS, James Dyer served the Town of Wake Forest and its citizens as a Commissioner since December 2019; and

WHEREAS, Mr. Dyer served as ex-officio on the Town of Wake Forest Historic Preservation Commission; and

WHEREAS, Mr. Dyer diligently and forthrightly worked to make the Town of Wake Forest a better place by carrying out his civic duties; and

WHEREAS, the Town of Wake Forest, its elected officials, employees, and its citizens individually and collectively commend Mr. Dyer for his service to the Town of Wake Forest.

NOW, THEREFORE, BE IT HEREBY RESOLVED by The Honorable Mayor and Board of Commissioners of the Town of Wake Forest that this **Resolution of Appreciation** be presented to James Dyer in acknowledgment of his service and his interest in good government in Wake Forest and the State of North Carolina.

Duly adopted this 19th day of December 2023.

(ATTEST) Vivian A. Jones, Mayor

Theresa Savary, Town Clerk

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-336-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Oaths of Office for Commissioners-elect

Recommendation:

Item Summary:

ATTACHMENTS

- Summary_Oaths of Office for Candidates Elect_Dec202319.pdf
- OathOfOffice_CommissionerWright_Dec202319.pdf
- OathOfOffice_CommissionerCross_Dec202319.pdf
- OathOfOffice_CommissionerClapsaddle_Dec202319.pdf

Agenda Item: Oaths of Office for Commissioners-elect.

Summary: The Commissioners-elect will be sworn in and take their seat at the dais:

- Commissioner-elect Adam Wright is being sworn in by The Honorable Terence Everitt, NC House Representative Terence Everitt.
- Commissioner-elect Faith Cross is being sworn in by The Honorable Vivian A. Jones, Mayor of the Town of Wake Forest, North Carolina.
- Commissioner-elect Ben Clapsaddle is being sworn in by The Honorable Vivian A. Jones, Mayor of the Town of Wake Forest, North Carolina.

Attachments: Oath of Office for Commissioners-elect Wright, Cross, and Clapsaddle.

COMMISSIONER OATH OF OFFICE

North Carolina
Wake County

I, Adam Wright, do solemnly and sincerely swear (or affirm) that I will support the Constitution of the United States; that I will be faithful and bear true allegiance to the State of North Carolina, and to the constitutional powers and authorities which are or may be established for the government thereof; and that I will endeavor to support, maintain and defend the Constitution of said State, not inconsistent with the Constitution of the United States, to the best of my knowledge and ability; and that I will faithfully and impartially discharge the duties as Commissioner for the Town of Wake Forest, North Carolina, so help me God.

Signature: _____ Date: _____

Sworn to (or affirmed) and subscribed before me this the 19th day of December 2023.

_____
Oath of Office Administered by:
NC House Representative Terence Everitt

COMMISSIONER OATH OF OFFICE

North Carolina
Wake County

I, Faith Cross, do solemnly and sincerely swear (or affirm) that I will support the Constitution of the United States; that I will be faithful and bear true allegiance to the State of North Carolina, and to the constitutional powers and authorities which are or may be established for the government thereof; and that I will endeavor to support, maintain and defend the Constitution of said State, not inconsistent with the Constitution of the United States, to the best of my knowledge and ability; and that I will faithfully and impartially discharge the duties as Commissioner for the Town of Wake Forest, North Carolina, so help me God.

Signature: _____ Date: _____

Sworn to (or affirmed) and subscribed before me this the 19th day of December 2023.

_____
Oath of Office Administered by:
Vivian A. Jones, Mayor
Town of Wake Forest, North Carolina

COMMISSIONER OATH OF OFFICE

North Carolina
Wake County

I, Ben C. Clapsaddle, do solemnly and sincerely swear (or affirm) that I will support the Constitution of the United States; that I will be faithful and bear true allegiance to the State of North Carolina, and to the constitutional powers and authorities which are or may be established for the government thereof; and that I will endeavor to support, maintain and defend the Constitution of said State, not inconsistent with the Constitution of the United States, to the best of my knowledge and ability; and that I will faithfully and impartially discharge the duties as Commissioner for the Town of Wake Forest, North Carolina, so help me God.

Signature: _____ Date: _____

Sworn to (or affirmed) and subscribed before me this the 19th day of December 2023.

_____
Oath of Office Administered by:
Vivian A. Jones, Mayor
Town of Wake Forest, North Carolina

Board of Commissioners Agenda Item Report

Agenda Item No.: 2023-358-
Submitted by: Terry Savary
Submitting Department: Administration
Meeting Date: December 19, 2023

SUBJECT
Election of Mayor Pro Tem (Item added to agenda 12/19/2023)

Recommendation:

Item Summary:

ATTACHMENTS