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July 13, 2021

Melanie Bachman, Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Re: 690 Line Rebuild Project

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") is requesting a Declaratory Ruling that no Certificate of Environmental Compatibility and Public Need is required for the proposed modifications to an existing 69-killovolt transmission line, ("690 Line Rebuild") in the Towns of Salisbury, Sharon and Canaan (Falls Village), Connecticut ("Petition").

Prior to submitting this Petition, representatives from Eversource briefed municipal officials in Salisbury, Sharon and Canaan about the Project. Eversource provided written notice of the proposed work to all abutters and of the filing of this Petition with the Connecticut Siting Council. Maps and line lists identifying the abutting property owners who were notified of the Project are provided in the Petition as Attachment A: 690 Line Rebuild Project – Aerial Maps.

Per the Council's instructions in response to COVID-19, Eversource is submitting this filing electronically and will be providing one hard copy for the Council's records. Eversource further understands that the Council will invoice the Company for the requisite $625 filing fee.

Sincerely,

Kathleen M. Shanley

Enclosure

cc: Mr. Curtis Rand, First Selectman, Town of Salisbury
Mr. Brent Colley, First Selectman, Town of Sharon
Mr. Henry Todd, First Selectman, Town of Canaan (Falls Village)

THE CONNECTICUT LIGHT AND POWER COMPANY

doing business as

EVERSOURCE ENERGY

PETITION TO THE CONNECTICUT SITING COUNCIL
FOR A DECLARATORY RULING OF
NO SUBSTANTIAL ADVERSE ENVIRONMENTAL EFFECT
FOR THE PROPOSED MODIFICATIONS TO THE EXISTING
690 LINE IN THE TOWNS OF SALISBURY, SHARON AND CANAAN (FALLS VILLAGE),
CONNECTICUT

1. Introduction

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource" or the "Company") hereby petitions the Connecticut Siting Council ("Council") for a Declaratory Ruling that no Certificate of Environmental Compatibility and Public Need ("Certificate") is required pursuant to Section 16-50g et seq. of the Connecticut General Statutes for the modifications to the 690 Line, a 69-kilovolt ("kV") transmission line, located within existing transmission rights-of-way ("ROWs") in the Towns of Salisbury and Sharon, and at Falls Village Substation in Canaan (Falls Village), Connecticut ("Towns"), as described herein (the "Project") (See Figure 1 - Project Overview Map below). Eversource submits that a Certificate is not required because the proposed modifications would not have a substantial adverse environmental effect.

2. Purpose of the Project

The purpose of the Project is to improve system reliability by rebuilding approximately 1.6 miles of the 690 Line within Eversource's ROW that connects Salisbury Substation in Salisbury, Connecticut to the Central Hudson Gas and Electric Corporation ("CHG&E") transmission system at the Connecticut/New York state line in Sharon. The state line runs north to south, bisecting Indian Lake. The 690 Line runs from east to west across the lake and the interconnection point between the Eversource transmission system and the CHG&E

system is over the approximate middle of the lake. The 690 Line currently consists of 11 lattice towers with 4/0 conductors and one alumoweld shield wire. Ten lattice structures will be replaced with weathering steel monopoles.[1] One new monopole structure (Structure 1052.5) would be constructed just west of Salisbury Substation.[2] The existing conductor will be replaced with a single-circuit 556-kcmil conductor and the alumoweld shield wire will be replaced with one optical ground wire ("OPGW").

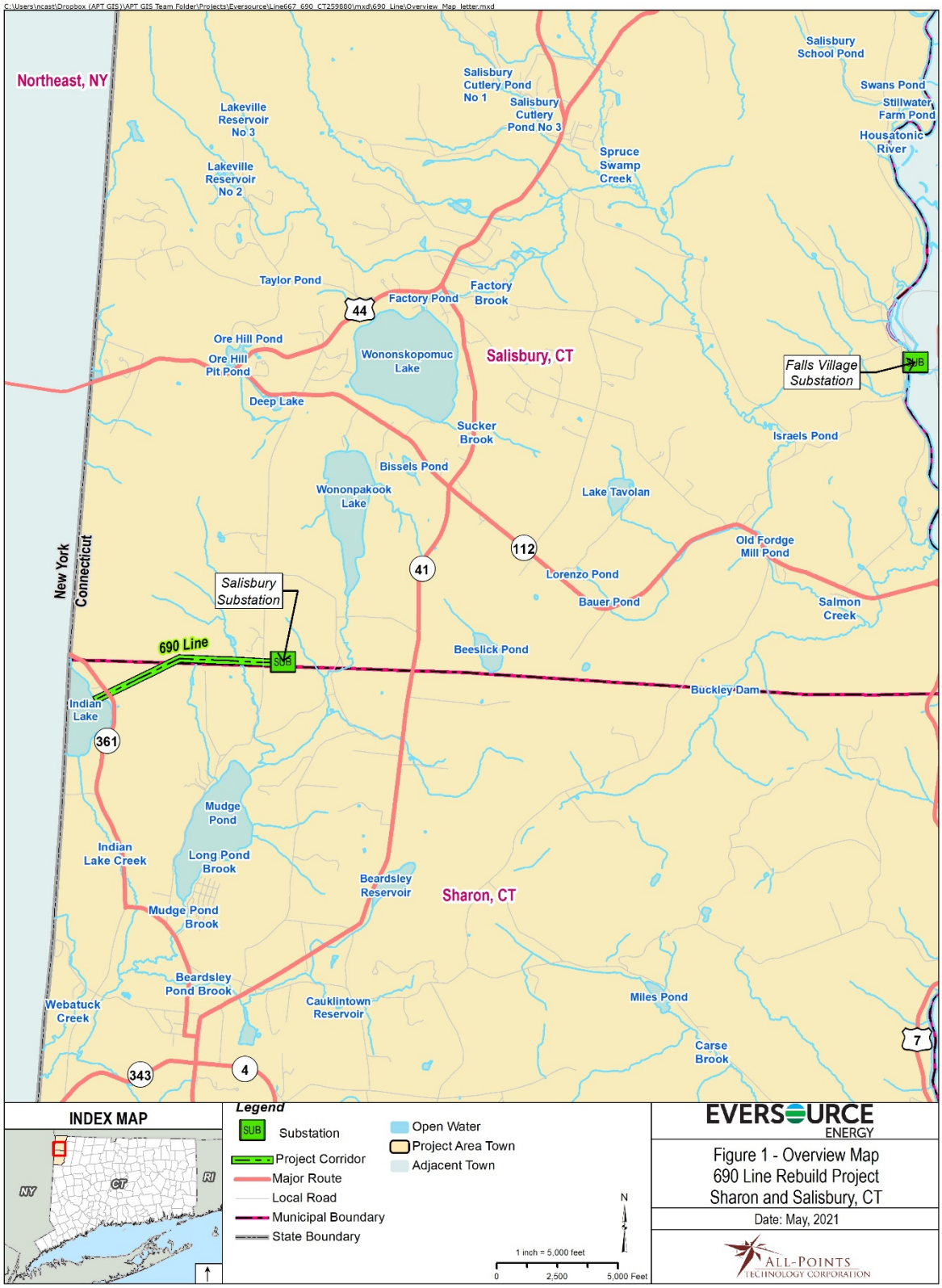
The 690 Line lattice towers were originally erected in 1926. Engineering analyses were completed on the structures and have determined that the existing structures are showing signs of age-related deterioration (bent steel members, corrosion, deteriorated concrete foundations and weathered and rusted hardware). The current conductor on the 690 line is 4/0 aluminum conductor steel reinforced ("ACSR"), which is no longer a standard conductor and has been prone to failure. The nearest standard replacement for this conductor is 556 aluminum conductor steel supported ("ACSS") which is 260% heavier than the existing conductor. To safely support the heavier conductor, the existing structures would need to be replaced with stronger structures. The replacement of the conductor and the degraded lattice structures will reduce the risk of age-related failures, mitigate safety concerns associated with additional construction loads on tower arms during routine maintenance and emergency work (e.g. workers climbing towers to conduct repairs) and ensure that both the structures and conductor meet the latest design standards. In addition to the rebuilding of the line, the Project

[1] The one structure that will not be replaced as part of the Project (Structure 1063) is located on the eastern shore of Indian Lake. Due to the height of the structure and the length of the span across Indian Lake, replacement of this structure will require significant coordination with CHG&E to ensure that the line clearances, tensions, configuration and structure strength are consistent on both sides of the lake. At this time, the replacement of the structure on the west side of the lake and the line over the lake is not a priority of CHG&E. Although Eversource would prefer to replace the structure as part of the Project, it cannot do so until CHG&E is prepared to collaborate on the design of the replacement components.

[2] The new structure is necessary to reduce the sag and the resulting conductor tension between the terminal structure at Salisbury Substation and Structure 1053.

will include the temporary installation of stand by generation at both Falls Village and Salisbury substations to address an unacceptable risk of a single contingency line loss ("SCLL") resulting from the need to take the 690 Line out of service during construction.

Figure 1: Project Overview Map



3. Project Description

A. Structures, Conductors and OPGW

The Project scope consists of reconductoring and structure replacement for the 690 Line along 1.6 miles of the existing ROW.

Details of the proposed scope of work are summarized as follows:

- Replace 10 steel lattice structures with weathering steel monopole structures and install one new weathering steel structure, which would generally be constructed in a delta-configuration;
- Replace the existing 4/0 ACSR with a single 556-kcmil ACSS conductor;
- Replace the existing alumoweld overhead shield wire with one new 48-fiber OPGW;
- Install new hardware, insulators, lightning arresters and counterpoise;
- Improve and/or install access roads and work pads to support the proposed scope of work.[1]

The Project work would require some tree clearing and vegetation removal (mowing) and or trimming to accommodate the work or to meet the required conductor clearances.

The maps in Attachment A: "690 Line Rebuild Project – Aerial Maps", dated May 2021, depict the locations of existing and proposed access roads, existing and proposed

[1] Access within the ROW from Millerton Road, on the western end of the project, is not possible due to the presence of very steep topography and exposed rock cliffs. Access to the ROW will utilize an existing off-ROW easement along an unimproved logging road, which will need to be improved and expanded to accommodate construction equipment.

structures, work pads to be used for the Project, wetland areas and other ROW features and Project elements.

The cross-section drawings in Attachment B – "Line 690 Right of Way Cross Section" depict typical views along the ROW of the existing and proposed structures, the existing and proposed limits of managed and unmanaged ROW areas and areas of vegetation removal. Attachment C – "List of Structure Replacements" provides information on existing and proposed structure heights. The heights of the existing structures range from 74 to 92 feet above ground level ("AGL"). The replacement structures must be taller than the existing structures to accommodate the change from the current horizontal configuration of the conductors on lattice structures to a delta-configuration of the conductors on monopoles and to meet current NESC clearance requirements. The replacement structures will range in height from 84 feet to 131 feet above ground level. Replacement structures, on average, will be approximately 26 feet taller than the corresponding existing structures. However, Structures 1057,1058, and 1062 will be 49 feet, 32 feet and 44 feet taller, respectively. The height increases are necessary to prevent clearance violations and to reduce uplift forces on structures that are located at lower elevations than adjacent structures.

B. Single Contingency Loss of Load ("SCLL") Mitigation

In addition to the rebuilding of the 690 Line, the Project must address a SCLL condition that has the potential to interrupt service to residences and "sensitive customers", served by Falls Village Substation and Salisbury Substation while the 690 Line is out of service.[2]

[2] Examples of "sensitive customers" from Eversource's System Operating Procedure ("ESOP 28") "Single Contingency Line Loss", dated April 29, 2019, include hospitals, municipal facilities and significant commercial and industrial customers.

As explained in Eversource's Petition No. 1371, which had a similar concern regarding an SCLL, one of the "sensitive customers" is Becton-Dickinson, a company that manufactures COVID-19 test kits and syringes for the COVID-19 vaccines. Becton-Dickinson is served by the North Canaan Substation, which is fed solely by the Falls Village Substation. Another "sensitive customer" that could potentially be interrupted during the 690 outage is Sharon Hospital, which is served by the Salisbury Substation. As shown in Figure 2 – Line Configuration Diagram (below), Falls Village Substation has two sources of energy: the 693/689 Lines from Torrington Terminal and the 690 Line from New York (CHG&E), through Salisbury Substation. Falls Village Substation is connected to the Salisbury Substation by the 667 Line and the North Canaan Substation via the 694 Line.

Figure 2 – Line Configuration Diagram

There is greater risk of service interruptions with the 690 Line out of service than there was with the 667 Line out of service. With the 667 Line out, loss of the Torrington Terminal autotransformer, would interrupt Falls Village and North Canaan. Loss of the 690 Line would interrupt Salisbury Substation. The customers fed from Salisbury Substation are backed up by Falls Village substation. However, with the 690 Line out of service, the loss of the Torrington Terminal autotransformer, would interrupt Falls Village, North Canaan, and Salisbury substations simultaneously, with very few customers being able to be picked up by other substations. To reduce the risk of loss of service to the customers served by

these three substations, a total of 32 MW of temporary back-up generation is needed. At Falls Village Substation, 22 MW of temporary generation is required. In addition, with the 690 Line out of service, there is no ability to convey power from CHG&E to Falls Village Substation and 10 MW of temporary back-up generation must be installed at Salisbury Substation to mitigate interruption of service.

1. Falls Village Substation Generation Installation

The solution to address the SCLL condition is nearly identical to the installation that was implemented for the 667 Line (Petition No, 1371), but will include one additional 2 MW generator unit. The installation would consist of 22 MW of temporary, trailer-mounted, diesel-fired stand-by generators at the Falls Village Substation to be located within and adjacent to Eversource's easement area, outside the existing Substation fence. The stand-by generators and associated support equipment would arrive on 16 trailers, each approximately 53 feet long; the trailers would be stationed in an approximately 200 feet by 200 feet area on temporary construction matting on the west side of the Substation. There would be eleven 2-megawatt generators (1 unit per trailer), six 2500-KVA transformers (2 units per trailer), one 10,000-KVA transformer (on its own trailer) and associated cables to connect the generators to the Falls Village Substation mobile generator position. Each generator is installed within a sound attenuating enclosure with approximate dimensions of 14 feet tall, 8 feet wide and 40 feet long. Each unit is also equipped with a self-contained diesel fuel tank (1000 gallons tank capacity, 5 hour run time per tank). All of the trailers/units will be positioned within an impermeable inflatable berm to provide containment. Though not anticipated, any refueling of the stand-by generators will be undertaken within the containment area. This SCLL solution will be essentially the same as the temporary generation

installation (with the addition of 2 MW) that was used in connection with the 667 Line Rebuild project, which was approved by the Council on September 9, 2020, as an amendment to Petition No. 1371. The equipment layout and equipment specifications are included in Attachment D – Falls Village Substation- Equipment Layout and Description.

2. Salisbury Substation Back-Up Generation Installation

At Salisbury Substation, a similar temporary installation will be required. Smaller equipment components will be used to optimize the space available within the fenced area of the Substation. The 10 MW temporary generation would be comprised of six one-MW generators, eight 0.5-MW generators, four 2500-KVA transformers, two 15-kV breaker switch combinations and connecting cables. The equipment would be located entirely within the fenced area of the Salisbury Substation and would include the same protections as the Falls Village Substation temporary installation. The equipment layout and specifications are included in Attachment E – Salisbury Substation – Equipment Layout and Description.

4. Existing Environment, Environmental Effects and Mitigation

A. Structures, Conductors and OPGW

The Project construction would be performed predominantly within the existing transmission ROW or on Eversource owned property. Off-ROW access is required from Millerton Road (Route 361) because access within the ROW is prohibitively challenging due the presence of some extreme slopes (in spots, cliffs) and very shallow and exposed bedrock. No expansion of the existing ROW would be required for the Project work. The Project would not have a substantial adverse environmental effect, for reasons explained more fully below.

Land Use

Land uses adjacent to the Project area consist of a mix of rural residential areas, agricultural, and undeveloped lands such as forests, and meadows. Though the Project would traverse through some of these areas, it will not impact adjacent land uses. Eversource will work with any affected property owners to restore property conditions upon completion of the Project.

Vegetation Removal

The Project ROW is 150 feet wide, with a maintained width that varies from approximately 70 feet to approximately 100 feet along the ROW. While the majority of the Project would be located within the maintained ROW, some clearing, selective tree removal and vegetation removal/tree trimming would be required in select areas to accommodate access road installation and improvements, for work pad installation, to remove

incompatible species, and along the Project ROW where conductor clearance is inadequate.

In most locations, vegetation removal would be accomplished using mechanical methods. This work typically requires the use of flat-bed trucks, brush hogs or other types of mowing equipment, skidders, forwarders, bucket trucks for canopy trimming, and chippers.

Eversource would require the clearing contractor to use low-impact clearing methods to remove brush vegetation to protect wetlands, watercourses, vernal pools, state-listed species and their habitats, and cultural resources. Low-impact clearing incorporates a variety of approaches, techniques, and equipment to minimize site disturbance. Eversource would require the contractor to use some or all of the following low impact clearing methods, depending on site-specific considerations:

- Take into consideration soil and weather conditions when scheduling vegetation removal activities, such as during periods of heavy rainfall.
- Utilize hand clearing methods for vegetation removal work within sensitive wetland and vernal pool areas (W9 and VP1);
- Maximize the use of uplands for clearing access routes;
- Use appropriately sized equipment for the site conditions, where possible, to minimize impacts; and,
- Where practical, cut brush close to the ground, leaving root systems and stumps, to retain soil stability.

The tree removal required for the Project that would be completed to maintain proper clearance from conductors would take place primarily within the existing ROW, except for

locations associated with the improvement of the access road originating at Millerton Road. It is estimated that within the 1.6 miles ROW, work would result in a total permanent conversion of approximately 1.07 acres of forest habitat to scrub-shrub or herbaceous habitat areas. The vegetation that would need to be removed for the construction of the off-ROW access road from Millerton Road would result in the removal of approximately 3.27 acres of forest habitat. Given the limited extent of forest conversion to shrubland, or emergent vegetation, there will be no significant adverse effect to forested habitat. Further, additional shrubland and early successional habitat (and the preservation of such existing habitat) along the ROW or access roads is beneficial for many species of wildlife because shrubland habitat is otherwise declining in New England[3].

Temporary construction mats would be used to provide a stable base for equipment across watercourses or within wetlands where hand clearing work is not feasible. Such temporary support would minimize temporary disturbances to wetland soils, and the mats would be removed after the activities are complete. Work activities in wetlands, including the proposed tree removal, will be conducted in accordance with the Eversource's 2016 *Construction & Maintenance Environmental Requirements, Best Management Practices Manual for Massachusetts and Connecticut* ("BMPs") and comply with Project permits and approvals.

After the installation of the rebuilt line, Eversource would perform ROW restoration in accordance with the protocols specified in Eversource's BMPs and based on consultations with the property owners affected by the Project.

[3] Connecticut's Wildlife Action Plan has identified 47 wildlife species of Greatest Conservation Need (GCN) as being associated with shrubland habitat and in need of active management.

Scenic, Recreational and Cultural Resources

The Project is not anticipated to have a substantial adverse effect to scenic, recreational and cultural resources. The alignment of replacement structures and conductors will be very similar to the existing line and the monopole structures will present a more streamlined appearance than the existing lattice structures. No portion of the ROW traverses or is located near a locally or state designated scenic roadway.

A desktop review of the Connecticut Department of Energy and Environmental Protection's ("CT DEEP") GIS and field investigations data was conducted to identify where portions of the ROW traverse or are adjacent to public open space property or trails. No public open space property or trails were identified along the Project ROW.

A cultural (archaeological and historical) resource review of the proposed Project area was conducted by Heritage Consultants, LLC ("Heritage") in September and December 2020. This review included the following:

- A Phase 1A preliminary archaeological and historical resources assessment using a three-step approach to: 1) gather and present data regarding previously identified cultural resources situated within the vicinity of the 690 Line; 2) investigate natural and historical characteristics of the Project area; and 3) evaluate the need for completing additional cultural resources investigations. The Phase 1A determined that there were no previously identified archaeological sites, National or State Register of Historic Places ("NRHP") properties/districts, or inventoried historic standing structures located within 500 feet of the proposed Project area. The Phase 1A identified eight (8) locations within the Project area as having a moderate to high potential for archaeological sensitivity, prompting further investigation via the execution of a Phase 1B survey.

- A Phase 1B cultural resources reconnaissance survey (shovel testing at 27 locations) was completed based on the Phase IA assessment. The Phase 1B survey identified one area along the access road that yielded miscellaneous historical artifacts but lacked substantial intact deposits and cultural features. This location was assessed as not eligible for listing on the National Register of Historic Places and no additional archaeological examination of this location or the remainder of the Project is recommended prior to construction. The results of the Phase 1B survey were provided to the State Historic Preservation Office ("SHPO") and the Tribal Historic Preservation Offices ("THPO") of the Mohegan Tribe of Native Americans of Connecticut and the Mashantucket Pequot Tribal Nation on December 24, 2020. The SHPO responded on February 9, 2021, concurring with the findings of the report. SHPO stated:

  "…that the area along [the access road] is not eligible for listing on the National Register of Historic Places, and that additional archeological investigations of the Project areas are not warranted. No historic properties will be affected by the proposed activities. However, please be advised that if construction plans change to include previously uninvestigated/undisturbed areas, SHPO should be contacted for additional consultation.

  At the time of submission of this Petition, Eversource has not received a response from either Tribal Nation.

  Wetlands, Watercourses, Waterbodies and Flood Zones

  Eversource identified and delineated water resources in the Project area during February, March, and April 2018 and March 2021 (see Attachment F: Wetlands and Watercourses Report; see also the map sheets provided in Attachment A, which depict such water resources). Water resources include inland wetlands, watercourses (perennial and intermittent streams), a lake (Indian Lake), a vernal pool, and Federal Emergency

Management Agency ("FEMA") Flood Zones. All work in or near these areas would be conducted in accordance with Eversource's BMPs and with the conditions of applicable regulatory permit conditions and approvals. Details on each of these resource areas are provided below.

Wetlands

Wetlands in the Project area were identified and delineated in accordance with industry standard methodology. A total of 11 wetlands were identified in or proximate to the Project area.

There is currently one structure (Structure No. 1063) located within wetlands, which will not be replaced as part of the Project. The Project will result in approximately 0.53 acre of temporary effects to wetlands due to the placement of construction mats for access roads and work pads. All construction mats will be promptly removed upon Project completion and wetland areas will be restored in accordance with Eversource's BMPs.

Anticipated effects to wetlands from the Project are detailed on Table W-1.

Watercourses and Waterbodies

A total of 15 watercourses and waterbodies were delineated within the Project area. These include four perennial watercourses (three unnamed [S10, S11, S12] and Spring Brook), ten intermittent watercourses, and Indian Lake.

Seven temporary watercourse crossings will be required during construction for access roads. Each of these watercourses will be spanned using temporary construction mats. All construction mats will be promptly removed upon Project completion and wetland areas

will be restored in accordance with Eversource's BMPs. The following Table W-1 provides a summary of Project effects to wetlands and watercourses:

Table W-1: Summary of Project Effects to Wetlands and Watercourses

Wetland / Watercourse ID	200 Scale Petition Mapping Sheet No.	Wetland / Watercourse Effects (± square feet)		
		Temporary (Matting)	Permanent (Structures)	Secondary (Selective Tree Removal)
W1	01	7,112	0	0
W2, S2, S4, S5	01	10,780	0	23,310
S6	01	246	0	0
S7	01	174	0	0
W4, S8	01	401	0	1,011
W7, S10	02	550	0	518
W8/S11	02	0	0	2,641
W9	03	0	0	10,659
W10, S13	03	3,795	0	68
TOTAL		23,058 sq. ft. (0.53 acre)	0	38,207 (0.88 acre)

Vernal Pools

The Project area was initially surveyed for vernal pools in spring 2018 and subsequently in the spring of 2020. Survey methods used included visual surveys to identify adults, larvae and egg masses, audial surveys to record breeding choruses and dip-net surveys to identify amphibian larvae. One vernal pool was identified and delineated. The vernal pool and associated vernal pool envelope (area within 100 feet of a vernal pool depression) are shown in Attachment A. The survey results and recommended protection

measures are provided in Attachment G: Vernal Pool Survey. To minimize potential effects to the vernal pool, Eversource would adopt the recommended protection measures detailed in Attachment G.

FEMA Flood Zones

The Project ROW extends across 100-year FEMA flood zones associated with Indian Lake, Spring Brook (S11), and Wetland W9. None of the replacement structures are proposed to be located within the 100-year flood zones.

Water Supply

Based on Aquifer Protection Areas ("APA") mapping maintained by CT DEEP, there are no APAs within or proximate to the Project ROW. The Project is not located within a public water supply watershed and no public supply reservoirs or public water supply wells are located within the Project area. No private water supply wells were observed within the Project area during field investigation activities.

Eversource would require its contractors to employ best practices for the proper storage, secondary containment, and handling of diesel fuel, motor oil, grease and other lubricants, to protect water quality within the Project area. Construction activities would conform to Eversource's BMPs, as well as to the requirements of Project-specific plans (e.g., Stormwater Pollution Control Plan; Spill Prevention and Control Plan), which would be prepared prior to the commencement of construction.

Wildlife and Habitat

The Project area extends through a variety of habitat types, including managed shrubland, forest edge, emergent marsh, wet meadow, and scrub-shrub habitat types. Notable

habitats present include Indian Lake at the western terminus of the Project and Wetland W9, a sloping fen with an embedded cryptic vernal pool that occurs within the ROW northwest of Drum Road. The Project transmission line structure and conductor replacement is not anticipated to have a substantial adverse environmental effect on wildlife habitat.

In November of 2020, Eversource submitted a Natural Diversity Database ("NDDB") State-listed Species Review request to the CT DEEP for the proposed structure replacement activities on the 690 Line within the NDDB-mapped habitat area. The NDDB response received in December 2020 acknowledged surveys performed for one state and federal-listed species[4] known to occur within or near the Project area and confirmed the survey results that documented the absence of this species in the Project area. CT DEEP concurred in its response letter that negative impacts to state-listed species are not anticipated from the Project.

In addition to coordinating with the NDDB, Eversource consulted with the U.S. Fish & Wildlife Service's ("USFWS") Information, Planning, and Consultation ("IPaC") service regarding federal-listed species that may be present within the Project area. The IPaC report indicated two federal-listed species, both of which are also state-listed. As indicated from Eversource's correspondence with NDDB, these species are not anticipated to be negatively impacted by the Project.

[4] To protect the state listed rare, threatened and special concern species and their habitats, no details are included in this Petition regarding species/habitat types, names or locations. The Attachment A mapping provides only general areas of the Project area as identified publicly by NDDB.

Visual Effects

The Project would result in some change to the visual character of the line, though Eversource does not believe that the change would result in a substantial difference. While slightly taller and of a different design than the existing structures they will be replacing, replacement monopole structures would be located as close as possible to locations of the existing structures and would present a more streamlined appearance. These visual effects would be further softened by utilizing weathering steel for the new structures allowing them to blend in more easily from views through existing vegetation, further minimizing visual impacts to the surrounding areas. As a result, the Project would not result in a detrimental change to the existing visual character of the line in this area, from nearby residential developments and publicly accessible land and in some locations would improve the view within and along the ROW.

Sound Levels along the Transmission ROW

The construction of the Project would result in short-term and localized noise, as is typical of similar construction projects. The temporary increase in noise would likely raise localized ambient sound levels immediately surrounding the work areas due to the operation of standard types of construction equipment. (e.g., backhoe, bulldozer, crane, trucks, etc.)[5]. Upon completion of construction and during operation, the proposed Project would not have any effect on noise or sound pressure levels. Once in service, the rebuilt lines would not result in any changes to ambient noise levels.

[5] Construction noise is exempted under the Connecticut regulations for the control of noise, RCSA 22a-69-1.8(h).

Air Quality

Short-term, localized effects on air quality may result from the Project construction work, primarily from fugitive dust and equipment emissions. To minimize the amount of dust generated by construction activities, the extent of exposed/disturbed areas at any one time would be minimized. Vehicle emissions will be limited by requiring contractors to properly maintain construction equipment and vehicles, and by minimizing the idling time of equipment and vehicles, including diesel construction equipment, in accordance with Connecticut regulatory requirements[6]. Temporary gravel tracking pads would be installed at points of construction vehicle ingress/egress from the ROW to minimize the potential for equipment to track dirt onto local roads. To further minimize dust, water may be used to wet down disturbed soils or work areas with heavy tracking as needed.

Radio and Television Interference

There will be no increase in radio interference or audible noise from the operation of the new transmission facilities.

B. Falls Village Substation SCLL Mitigation

The temporary stand by generators would be located in an area that is currently developed by electric utility uses including the Falls Village Substation, a separate switchyard, and distribution and transmission lines. These components are located on a flat terrace along the east side of the Housatonic River. Areas adjacent to the fenced utility facilities, are maintained

[6] Regulations of Connecticut State Agencies (RCSA) Section 22a-174-18(b)(3)(C) generally prohibits the idling of motor vehicles for more than three consecutive minutes when not in motion.

as lawn. There is a buffer of trees along the west side of area that would not be disturbed (see Figure 3 – Falls Village Substation Overview).

Figure 3 – Falls Village Substation Overview

Note: Approximate area of generators is highlighted.

There are no wetlands, watercourses or other natural resources present in the area of the temporary installation. There are no Natural Diversity Database or cultural resource areas. However, there are two environmental considerations that will be managed and mitigated: location within the Housatonic River Floodplain and the potential for air emissions.

1.Housatonic River Floodplain - The site is located within the 100-year elevation of the Housatonic River. Floodplain limits are shown on Attachment D which depicts regulatory flood boundaries from the Federal Emergency Management Agency. To mitigate the potential risks

of a flood, a Flood Contingency Plan ("Plan") will be developed by the contractor prior to the start of construction. The Plan will require the contractor to monitor local weather conditions, secure the work site before predicted major storms and take measures to protect and secure materials, equipment and to protect personnel.[7] During construction, the contractor will also adhere to the procedures set forth in Eversource's BMPs that address the need for the contractor to maintain a stable work area. Eversource would assign an environmental inspector to the Project to ensure compliance with the provisions of the BMPs and to oversee the contractor's work for the duration of the Project as necessary to ensure compliance with all applicable environmental requirements and permit conditions. No fuel or other hazardous materials will be stored, except those within the generator tanks or transformers, within the 100-year floodplain at any time.

2. Potential Air Emissions – As described above, the diesel-fired stand by generators are not expected to run except for a limited duration during commissioning or unless there is a loss of load during the outage. The stand-by generators are "emergency engines" as defined in the Regulations of Connecticut State Agencies Section 22a-174-22e (13). Qualifying emergency engines can operate without being required to obtain a New Source Review Air Permit as long as they comply with the Regulations of Connecticut State Agencies Section 22a-174-3b. For an emergency engine the following requirements apply:

- Operation of engine does not exceed 300 hours during any twelve (12) month rolling aggregate period;
- Fuel consumed by the engine shall not exceed the sulfur content of motor vehicle diesel fuel; and

[7] A major storm shall be defined as a storm predicted by the National Oceanic and Atmospheric Administration weather service with warnings of flooding, severe thunderstorms, or similarly severe weather conditions or effects.

- Maintain records for five (5) years detailing the hours of operation of the engine and the amount of fuel consumption.

C. Salisbury Substation SCLL Mitigation

The temporary stand by generators would be located on Eversource-owned property off Indian Mountain Road at the Salisbury Substation (See Figure 4 – Salisbury Substation Overview). The property is occupied by the Substation and the corridor for the 690 and 667 Lines. The generation equipment would be located entirely within the existing Substation. Areas adjacent to the Substation are mostly cleared of vegetation, but there is a vegetated buffer along the southern property line, between the Substation and the closest residence that would remain. There is one small watercourse and associated wetlands located west of the Substation (designated as S15 and W11 on Attachment A. The access road from Indian Mountain Road to the Substation utilizes a culverted crossing over the watercourse. There are no Natural Diversity Database mapped areas, sensitive natural resources or cultural resource areas in the area of the Substation. Any air emissions from the back up generation would be subject to the same provisions as those at Falls Village.

Figure 4 – Salisbury Substation Overview

Note: Approximate location of generators is highlighted.

5. Traffic Management

Construction vehicles and equipment associated with the work would include, but are not limited to, pickup trucks, bucket trucks, flat-bed trucks, excavators, concrete trucks, drill rigs, front loaders, reel trailers, bulldozers, wood chippers, brush hogs/mowers, forklifts, side booms, dump trucks and cranes. Pullers and tensioners will be used for the line work. Guard trucks and/or temporary guard structures would be used for protection of roads during the line work.

Construction-related vehicular and equipment movements would utilize public roads in the Project area to access the ROW. However, the Project-related traffic is generally expected to be temporary and highly localized in the vicinity of the ROW access points and at the staging area. Due to phasing of construction work, these Project-related traffic movements are not expected to significantly affect transportation patterns or levels of service on public roads.

To safely move construction vehicles and equipment onto and off of the ROW while minimizing disruptions to vehicular traffic along public roads, Eversource or its Project contractor would, as appropriate, work with the Towns and the Connecticut Department of Transportation to develop and implement traffic management procedures, as needed. The construction contractor is typically responsible for posting and maintaining construction warning signs along public roads near work sites and for coordinating the use of flaggers or police personnel to direct traffic, as necessary.

6. Construction Sequence

Project construction would include the following activities:

Establishing Staging and Laydown Areas

The Project is proposing to utilize a property located at 166 Sand Road, Falls Village for a staging/laydown area. The area is approximately 6.7 acres total in size and would be located on the storage lot of the property (See Figure 5 – Staging/Laydown Area, below).

The staging area would be used for surface storage of construction materials, equipment, tools, and supplies (including conductors, cable reels, insulators, hardware, poles and mats) for the Project. Office trailers and Conex storage containers may be located at the staging areas. Components removed during the work (structures, conductor, hardware and insulators) may be temporarily accumulated and stored at the staging areas prior to removal

off-site for salvage and/or disposal. The staging area may also be used by construction crews for parking personal vehicles as well as for construction vehicles and equipment storage, and for performing minor maintenance, when needed, on construction equipment. Appropriate erosion and sedimentation ("E&S") controls would be installed and maintained until completion of the work in accordance with Project permits and Eversource's BMPs.

Figure 5: Staging and Laydown Areas at 166 Sand Road, Falls Village

Soil Erosion and Sediment Control Installation

Project construction would conform to best management practices for erosion and sedimentation ("E&S") control, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* ("*Connecticut Guidelines*") and Eversource's BMPs. This will include the development of a project specific Stormwater Pollution Control Plan ("SWPCP") and registration under CT DEEP's *General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, effective 12/31/2020 ("General Permit")*.

Typical E&S control measures include, but are not limited to, straw blankets, hay bales, silt fencing, gravel anti-tracking pads, soil and slope protection, water bars, check dams, berms, swales, plunge pools, and sediment basins. Silt fence would be installed prior to construction to intercept and retain sediment and/or construction materials from disturbed areas and prevent such materials from discharging to water resources or off ROW. Temporary E&S control measures would be maintained and inspected throughout the Project to ensure their integrity and effectiveness and for compliance with the General Permit. The SWPCP inspections will be in accordance with the General Permit requirements. Following completion of the rebuilt 690 Line facilities, seeding and mulching would be completed to permanently stabilize the areas disturbed by the work. The temporary E&S control measures would remain in place until the Project work is complete and all disturbed areas have been deemed and remain stabilized.

Access Roads and Work Pads

Access to each proposed transmission structure location will be required during Project construction and new access roads will be required. Construction matting will be utilized to install temporary access roads through wetland areas to reach certain structure locations.

The access roads expected to be used for the proposed Project are illustrated on the maps in Attachment A. Access roads would be constructed to provide a maximum travel surface that is approximately 16 feet wide and additional width would be needed at turning or passing locations. Due to the sloping topography, grading or filling of side slopes would be needed to support the required travel width. Access roads would typically be graveled; however, where access roads traverse streams or wetlands, temporary construction mats or rail car bridges would be used. E&S controls would be installed as necessary before the commencement of any improvements to or development of access roads.

At each transmission line structure location, a work pad is required to stage material for final on-site assembly and/or removal of structures, to pull conductors and to provide a safe, level work base for the construction equipment. Typical work pads are 100 feet by 100 feet but, due to terrain and spacing between the existing and proposed structures, the work pads may need to be slightly larger, up to approximately 110 feet by 120 feet. In areas where machinery is needed for pulling conductors through an angled structure, work pads of approximately 130 feet by 80 feet are required. Most work pads will be graveled, though some will use temporary matting to protect sensitive resource areas (i.e. wetlands, meadows, fields or other sensitive areas).

To facilitate future transmission line maintenance, access roads and structure work pads in uplands would be left in place (refer to attachment A). If an individual property owner requests their removal, the Project representatives will work with the property owner on mitigation options. No new permanent access roads or work pads are proposed in water resource areas.

The proximate locations and configuration of the work pads, as determined based on the environmental field studies and constructability reviews, are shown on Attachment A.

Foundation Installation

The proposed structures will have either drilled (caisson) foundations or direct embed foundations. Foundation installation work would require the use of equipment such as augers, drill rigs, pneumatic hammers, augers, dump trucks, concrete trucks, grapple trucks and light duty trucks. If groundwater is encountered, and when working within wetlands, pumping (vacuum) trucks or other suitable equipment would be used to pump water from the excavated areas as the shaft is being drilled or as the structure is being set. The water would then be discharged in accordance with applicable local, state and federal requirements.

Excavated soils that are generated during construction activities would be stored or spread in an upland area within the ROW, to the extent practicable. Materials that cannot be utilized as backfill would be disposed in accordance with applicable regulations.

As needed, counterpoise may also be installed at this time. Depending on site-specific soil conductivity, supplemental grounding will be installed. A quad “ditch-witch” plow-cable trencher would be used to install the counterpoise.

Structure Assembly/Installation

Structure sections, structure components and hardware would be delivered to the individual structure locations using flat-bed trucks and assembled on-site using a crane and bucket trucks. After assembly, the area around direct embed foundations would be backfilled with processed gravel.

Conductor and OPGW Installation

The installation of the new conductors and OPGW would occur after the new structures have been erected. The equipment required for these activities would include conductor reels, conductor pulling and tensioning rigs, and bucket trucks.

Structure, Conductor and Static Wire Removal

The removal of the existing conductor and shield wire would take place during the active installation of the new conductor and OPGW because the existing conductor and shield wire will be used as pulling lines, if possible. Conductor dead-ending and splicing will be accomplished with pressed hardware. The existing structures would be removed after the new conductor and OPGW are installed.

Restoration

Once the new structures are erected and the new conductor and OPGW installed, the line is energized and the existing structures have been demolished and removed, ROW restoration activities would commence. Restoration activities would include the removal of construction debris, signage, flagging, and temporary fencing, as well as the removal of construction mats and work pads that are designated for removal. Areas affected by construction would be re-graded as practical and stabilized using revegetation or other measures before removing temporary E&S controls. Eversource would perform ROW restoration in accordance with the protocols specified in Eversource's BMPs and in consultation with affected property owners.

Waste Management

Waste materials, such as structure components (i.e., materials from the removed structures, conductor, shield wire, associated hardware, etc.) and any other construction debris would be

disposed of in accordance with Eversource's BMPs, applicable regulations or recycled consistent with applicable rules and regulations and Eversource policies. As described above, excess soils would be managed in accordance with Eversource's BMPs, applicable regulations and disposal facility policies. Dewatering during construction activities would be conducted in accordance with the *Connecticut Guidelines,* Eversource's BMPs and applicable regulations.

7. Construction Schedule and Work Hours

Eversource proposes to begin construction in September or October 2021. Normal work hours would be Monday through Saturday from 7:00 AM to 7:00 PM. Sunday work hours or evening work hours past 7:00 PM may be necessary due to delays caused by inclement weather and/or outage constraints. In the event this is necessary, the Council, Town(s) and abutters will be provided notice of the proposed Sunday and/or evening work hours.

8. Electric and Magnetic Fields

Eversource prepared calculations of the existing and post-Project Electric and Magnetic fields ("EMF"). The calculations were based on average annual loading conditions because these are most representative of typical conditions. The calculations are made relative to the centerline of the proposed, modified transmission lines. The calculations apply at one meter (3.28 feet) above grade and assume that the lowest conductor for each 115-kV circuit is 30 feet above grade.

Eversource's proposed design for the Project employs a vertical configuration of three phase conductors supported on tubular steel poles for 1.1 miles, rolling to a single circuit delta configuration for the remaining 0.55 mile. The existing configuration is the same as the proposed but supported by lattice towers. Magnetic fields at and beyond the edges of the

ROW would be essentially unchanged or reduced throughout this portion of the line. Electric fields throughout the entire ROW would also be essentially unchanged or reduced.

Table 1 summarizes the calculated electric and magnetic fields at the ROW edges before and after the modifications.

Table 1 - Summary of Calculated Electric and Magnetic Fields

Salisbury S/S - Structure 1061		South ROW Edge	Max in ROW	North ROW Edge
Magnetic Fields (mG)	Existing	0.37	3.15	1.44
	Proposed	0.37	1.76	1.11
Electric Fields (kV/m)	Existing	0.03	0.48	0.04
	Proposed	0.02	0.29	0.08

Structure 1061 - NY/CT Border		South ROW Edge	Max in ROW	North ROW Edge
Magnetic Fields (mG)	Existing	0.55	1.38	0.88
	Proposed	0.38	0.62	0.48
Electric Fields (kV/m)	Existing	0.05	0.15	0.10
	Proposed	0.04	0.08	0.05

The results of the calculations show that the proposed modifications would not substantially increase electric or magnetic fields at the edges of the ROW. See Attachment H: EMF Graphs.

Comparison of Calculated Fields to International Guidelines

The anticipated fields resulting from the proposed Project are well below the internationally established exposure limits for 60-Hz electric and magnetic fields, specifically, the limits identified by the International Council on Electromagnetic Safety ("ICES") and the

International Council on Non-Ionizing Radiation Protection ("ICNIRP"). These standards are summarized below in Table 2.

Table 2 - International Guidelines for EMF Exposure

	Magnetic Field (mG)	Electric Field (kV/m)
ICNIRP	2000	4.2
ICES	9040	5 (in General)
		10 (on ROW)

9. Municipal and Property Owner Outreach

Throughout the spring 2021, Eversource consulted with the municipal officials in the Town of Salisbury to brief them on the proposed Project. Additionally, in June 2021, Eversource provided representatives of the Towns with written notice of the Petition filing.

During the Spring of 2021, Eversource conducted outreach to property owners located along the ROW. In conjunction with the submission of this Petition, all abutting property owners were notified of the filing and provided information on how to obtain additional information on the Project, as well as how to submit comments to the Council. Eversource representatives will continue contact with adjacent property owners to provide advance notification as to the start of construction activities and will continue to update property owners throughout construction and restoration.

10. Conclusion

Based on the foregoing, Eversource respectfully submits that the proposed modifications would not result in a substantial adverse effect on the environment, nor would they damage existing scenic, historical or recreational values. Accordingly, Eversource requests that the

Council issue a declaratory ruling that the proposed modifications would have no substantial adverse environmental effect.

Communications regarding this Petition for a Declaratory Ruling should be directed to:

Kathleen M. Shanley
Manager – Transmission Siting
Eversource Energy
PO Box 270
Hartford, CT 06141-0270
Telephone: (860) 728-4527

By: _____
Kathleen M. Shanley

List of Attachments

Attachment A: 690 Line Rebuild Project – Aerial Maps
Attachment B: Line 690 – Right-of-Way Cross Section
Attachment C: List of Structure Replacements
Attachment D: Falls Village Substation – Generation Equipment Layout and Description
Attachment E: Salisbury Substation – Generation Equipment Layout and Description
Attachment F: Wetlands and Watercourses Report
Attachment G: Vernal Pool Survey
Attachment H: EMF Graphs
Attachment I: Letter to Abutters and Affidavit of Service of Notice

Attachment A: 690 Line Rebuild Project – Aerial Maps

Map Sheet 2
Salisbury Substation
SUB
690 Line
Map Sheet 3
Map Sheet 1
Salisbury
Sharon
Camp Sloane
Wononpakook Lake
Indian Mtn Sch
The Cedars
Northeast Center
Webatuck
Indian Lake
Coleman Station
Mudge Pond
Beardsley Pond
Beerstick Pond
Camp Easton
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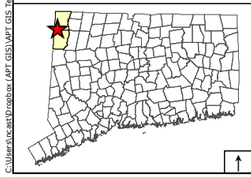
INDEX MAP



Legend

- SUB Substation
- Project Corridor
- Map Sheet
- Municipal Boundary
- State Boundary

N

1:24,000

Feet 0 1,000 2,000

Base Map Source: ESRI USA Topographic Maps

NO.	DATE	REVISIONS	BY	CHK	APP	APP

EVERSOURCE ENERGY

690 Line - Rebuild Project
Petition Index Map

Sharon and Salisbury, CT

Date: June, 2021

ALL-POINTS TECHNOLOGY CORPORATION

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MAP SHEET 01

690 Line Rebuild Project
Structures 1063 - 1060
Town of Sharon, Connecticut

AREA DESCRIPTION

Existing Land Use & Resource Areas
- Indian Lake
- Residential
- Undeveloped, forest
- 100-year Flood Zone
- Natural Diversity Database Area

RIGHT-OF-WAY DESCRIPTION

Right-of-Way ("ROW") Land Use & Resource Areas
- Maintained ROW
- Indian Lake east of structure 1063
- 100-year Flood Zone east of Structure 1063
- Natural Diversity Database Area at Structure 1063

Water Resources
- Wetlands: W1, W2, W3, W4, W5
- Wetland Cover Types: PSS, PEM, PFO
- Watercourses: S1, S2, S3, S4, S5, S6, S7, S8

Wetland and Watercourse Crossings
- Wetlands W1 – Construction mats for work pad and access road
- Wetland W2 – Construction mats for access road
- Wetland W4 – Construction mats for access road
- Stream S2 – Construction mats for access road
- Stream S4 – Construction mats for access road
- Stream S5 – Construction mats for access road
- Stream S6 – Construction mats for access road
- Stream S7 – Construction mats for access road
- Stream S8 – Construction mats for access road

Right-of-Way Vegetation
- Scrub-shrub

Access
- Structure 1063: New access off Millerton Road (CT361)
- Structures 1060 to 1062: New access off Millerton Road (CT361)

Road Crossings
- Millerton Road (CT361)

Existing Maintained Right-of-Way Width / Proposed Right-of-Way Clearing
- Varies/Varies

ABUTTERS TO THE PROJECT RIGHT-OF-WAY

LLN Number	Parcel Address	Town	Owner Name
018-014	33 DRUM ROAD	SHARON	JOHN G BRETT TRUSTEE OF THE JOHN G BRETT REV TRUST UAD 10
018-015	DRUM ROAD	SHARON	JOHN G BRETT TRUSTEE OF THE JOHN G BRETT REV TRUST UAD 10
018-017	MILLERTON ROAD	SHARON	CARL K OPPENHEIMER
018-018	300 MILLERTON ROAD	SHARON	BRIAN P QUINIF AND KRISTINE OCONNELL
018-019	232 MILLERTON ROAD	SHARON	OTTO VON AHN
018-021	MILLERTON ROAD	SHARON	CARL K OPPENHEIMER
018-022	MILLERTON ROAD	SHARON	CARL K OPPENHEIMER
018-023	295 MILLERTON ROAD	SHARON	STEVEN J BURDEN AND RUTH LEHMANN

INDEX MAP

Salisbury
Sharon
Canaan
Cornwall
New York
Connecticut

Legend

- Proposed Structure
- Existing Structure
- Existing Structure to be removed
- Culvert
- Existing Right-of-Way (ROW)
- Proposed ROW Easement
- Overhead Eversource Line
- Existing Access
- Proposed Access
- Stone Work Pad
- Temporary Construction Matting
- Existing Tree Line
- Area of Limited Tree Removal
- Ordinary High Watermark
- Delineated Perennial Watercourse
- Delineated Intermittent Watercourse
- Confirmed Vernal Pool Extent
- 100' Vernal Pool Envelope
- Delineated Wetland Boundary Outline
- Field Delineated Wetland
- Open Water
- Natural Diversity Database Area (Dec 2020)
- FEMA 100-Year Flood Zone
- Eversource Owned Property
- Parcel Boundary
- Municipal Boundary
- 5' Contour Line
- Map Sheet Matchline

Proposed Standby Generator Units at Salisbury Substation

- 0.5 MW Generator Unit
- 1 MW Generator Unit
- 15 KV Breaker Switch Combo
- 2500 KVA Transformer

Map Notes:
Parcel Boundaries provided by Eversource in Feb 2021 (not from survey).
ROW Boundary provided by Eversource Survey.
Wetland Delineation by Davison Environmental 2020-2021.

N

1 inch = 200 feet

0 50 100 200 Feet

NO.	DATE	REVISIONS

EVERSOURCE ENERGY

690 Line Rebuild Project

Sharon, CT

Map Sheet 1 of 3

June, 2021

ALL-POINTS TECHNOLOGY CORPORATION

MAP SHEET 02

690 Line Rebuild Project
Structures 1060 - 1058
Towns of Sharon and Salisbury, Connecticut

AREA DESCRIPTION

Existing Land Use & Resource Areas
- Residential
- Undeveloped, forest
- Agricultural
- 100-year Flood Zone
- Natural Diversity Database Area

RIGHT-OF-WAY DESCRIPTION

Right-of-Way ("ROW") Land Use & Resource Areas
- Maintained ROW
- 100-year Flood Zone between structures 1057 and 1058

Water Resources
- Wetlands: W-6, W-7, W-8, W-9,
- Wetland Cover Types: PFO, PSS, PEM,
- Vernal Pools: VP1
- Watercourses: S9, S10, S11, S12

Wetland and Watercourse Crossings
- Wetland W7 – Construction mats for access road
- Stream S10 – Construction mats for access road

Right-of-Way Vegetation
- Scrub-shrub
- Agricultural
- Forest

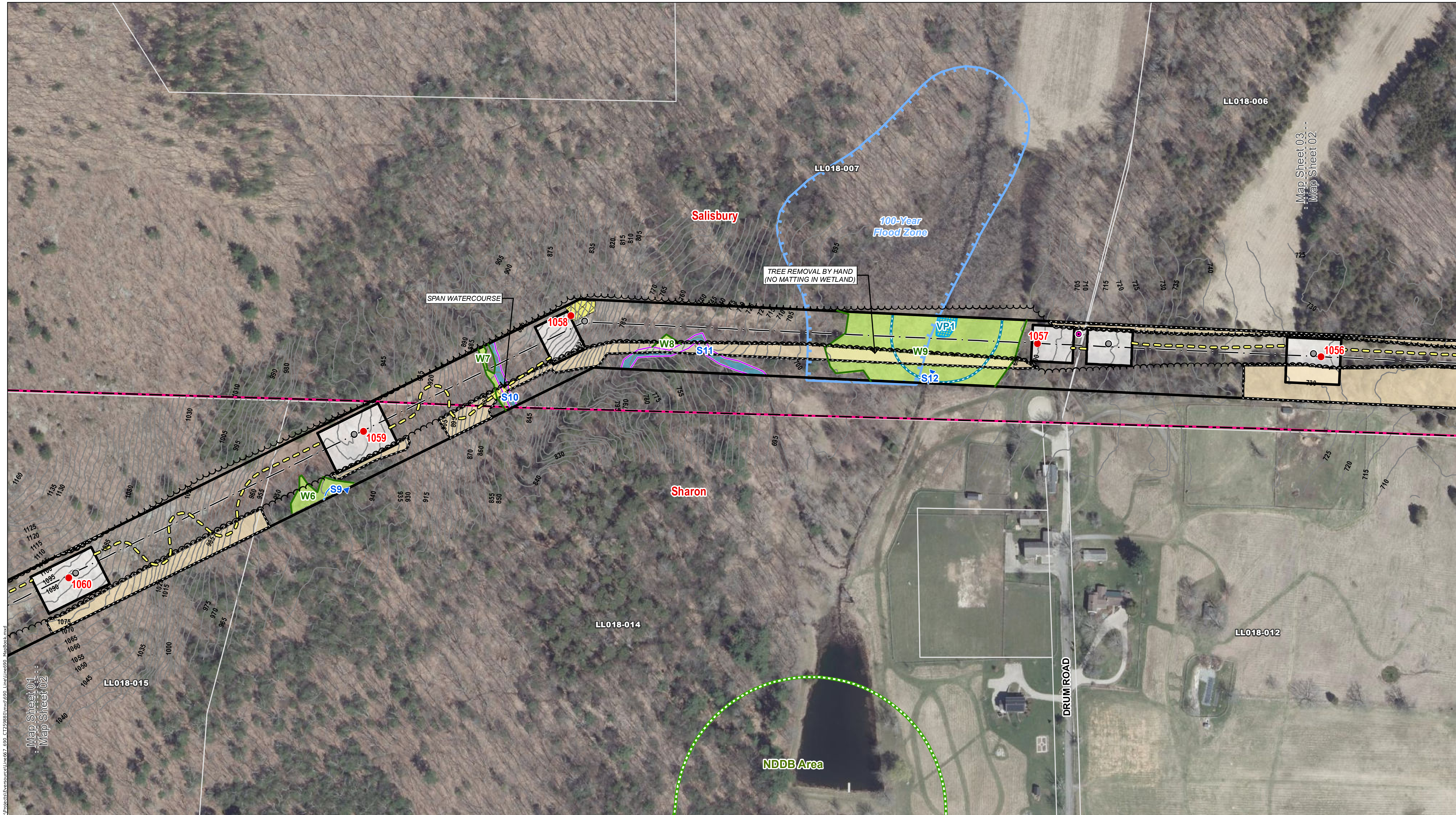
Access
- Structure 1056 and 1057: New and existing access off Indian Mountain Road
- Structures 1058 and 1059: New access off Millerton Road (CT361)

Road Crossings
- None

Existing Maintained Right-of-Way Width / Proposed Right-of-Way Clearing
- Varies/Varies

ABUTTERS TO THE PROJECT RIGHT-OF-WAY

LLN Number	Parcel Address	Town	Owner Name
018-006	JUNIPER LEDGE LANE	SHARON	PHILIP OPPENHEIMER
018-007	JUNIPER LEDGE LANE	SHARON	GREGORY FRANKS
018-012	34 DRUM ROAD	SHARON	BARRY S PINCHOFF AND BARBARA ZUCKER-PINCHOFF
018-014	33 DRUM ROAD	SHARON	JOHN G BRETT TRUSTEE OF THE JOHN G BRETT REV TRUST UAD 10
018-015	DRUM ROAD	SHARON	JOHN G BRETT TRUSTEE OF THE JOHN G BRETT REV TRUST UAD 10



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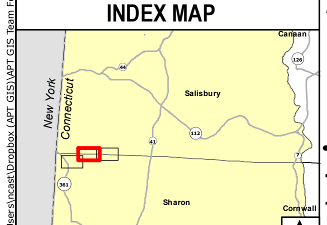

Legend

- Proposed Structure
- Existing Structure
- Existing Structure to be removed
- Culvert
- Existing Right-of-Way (ROW)
- Proposed ROW Easement
- Overhead Eversource Line
- Existing Access
- Proposed Access
- Stone Work Pad
- Temporary Construction Matting
- Existing Tree Line
- Area of Limited Tree Removal
- Ordinary High Watermark
- Delineated Perennial Watercourse
- Delineated Intermittent Watercourse
- Confirmed Vernal Pool Extent
- 100' Vernal Pool Envelope
- Delineated Wetland Boundary Outline
- Field Delineated Wetland
- Open Water
- Natural Diversity Database Area (Dec 2020)
- FEMA 100-Year Flood Zone
- Eversource Owned Property
- Parcel Boundary
- Municipal Boundary
- 5' Contour Line
- Map Sheet Matchline

Proposed Standby Generator Units at Salisbury Substation

- 0.5 MW Generator Unit
- 1 MW Generator Unit
- 15 KV Breaker Switch Combo
- 2500 KVA Transformer

Map Notes:
Parcel Boundaries provided by Eversource in Feb 2021 (not from survey).
ROW Boundary provided by Eversource Survey.
Wetland Delineation by Davison Environmental 2020-2021.

N

1 inch = 200 feet
0 50 100 200 Feet

NO.	DATE	REVISIONS

EVERSOURCE ENERGY

690 Line Rebuild Project

Salisbury and Sharon, CT

Map Sheet 2 of 3

June, 2021

ALL-POINTS TECHNOLOGY CORPORATION

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MAP SHEET 03

690 Line Rebuild Project
Structures 1058 – Salisbury Substation
Towns of Sharon and Salisbury, Connecticut

AREA DESCRIPTION

Existing Land Use & Resource Areas
- Eversource Owned Property
- Salisbury Substation
- Residential
- Undeveloped, forest
- 100-year Flood Zone

RIGHT-OF-WAY DESCRIPTION

Right-of-Way ("ROW") Land Use & Resource Areas
- Maintained ROW
- Eversource Owned Property at Structures 1053 and 1052.5
- Agricultural east of Structure 1054 to Indian Mountain Road
- 100-year Flood Zone between Structures 1054 and 1055

Water Resources
- Wetlands: W10 and W11
- Wetland Cover Types: PSS & PEM
- Watercourses: S13 (Spring Brook) and S14

Wetland and Watercourse Crossings
- Wetland W10 – Construction mats for access road
- Stream S13 – Construction mats for access road

Right-of-Way Vegetation
- Scrub-shrub
- Agricultural
- Hay Fields

Access
- Structure 1053 and 1052.5: Existing access off Indian Mountain Road
- Structures 1054 and 1055: New access off Indian Mountain Road

Road Crossings
- Indian Mountain Road

Existing Maintained Right-of-Way Width / Proposed Right-of-Way Clearing
- Varies/Varies

ABUTTERS TO THE PROJECT RIGHT-OF-WAY

LLN Number	Parcel Address	Town	Owner Name
018-001	316 INDIAN MOUNTAIN ROAD	SALISBURY	CONNECTICUT LIGHT & POWER CO. (EVERSOURCE)
018-003	310 INDIAN MOUNTAIN ROAD	SALISBURY	EMILY ELLIOT
018-004	311 INDIAN MOUNTAIN ROAD	SALISBURY	311 IMR LLC
018-005	19 JUNIPER DRIVE	SALISBURY	MARY ELIZABETH FREEMAN
018-006	JUNIPER LEDGE LANE	SALISBURY	PHILIP OPPENHEIMER
018-009	238 MUDGE POND ROAD	SHARON	ANN C TROTTA
018-012	34 DRUM ROAD	SHARON	BARRY S PINCHOFF AND BARBARA ZUCKER-PINCHOFF

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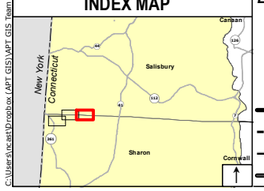
INDEX MAP



Legend

- Proposed Structure
- Existing Structure
- Existing Structure to be removed
- Culvert
- Existing Right-of-Way (ROW)
- Proposed ROW Easement
- Overhead Eversource Line
- Existing Access
- Proposed Access
- Stone Work Pad
- Temporary Construction Matting
- Existing Tree Line
- Area of Limited Tree Removal
- Ordinary High Watermark
- Delineated Perennial Watercourse
- Delineated Intermittent Watercourse
- Confirmed Vernal Pool Extent
- 100' Vernal Pool Envelope
- Delineated Wetland Boundary Outline
- Field Delineated Wetland
- Open Water
- Natural Diversity Database Area (Dec 2020)
- FEMA 100-Year Flood Zone
- Eversource Owned Property
- Parcel Boundary
- Municipal Boundary
- 5' Contour Line
- Map Sheet Matchline

Proposed Standby Generator Units at Salisbury Substation

- 0.5 MW Generator Unit
- 1 MW Generator Unit
- 15 KV Breaker Switch Combo
- 2500 KVA Transformer

Map Notes:
Parcel Boundaries provided by Eversource in Feb 2021 (not from survey).
ROW Boundary provided by Eversource Survey.
Wetland Delineation by Davison Environmental 2020-2021.

N

1 inch = 200 feet

0 50 100 200 Feet

NO.	DATE	REVISIONS

EVERSOURCE ENERGY

690 Line Rebuild Project

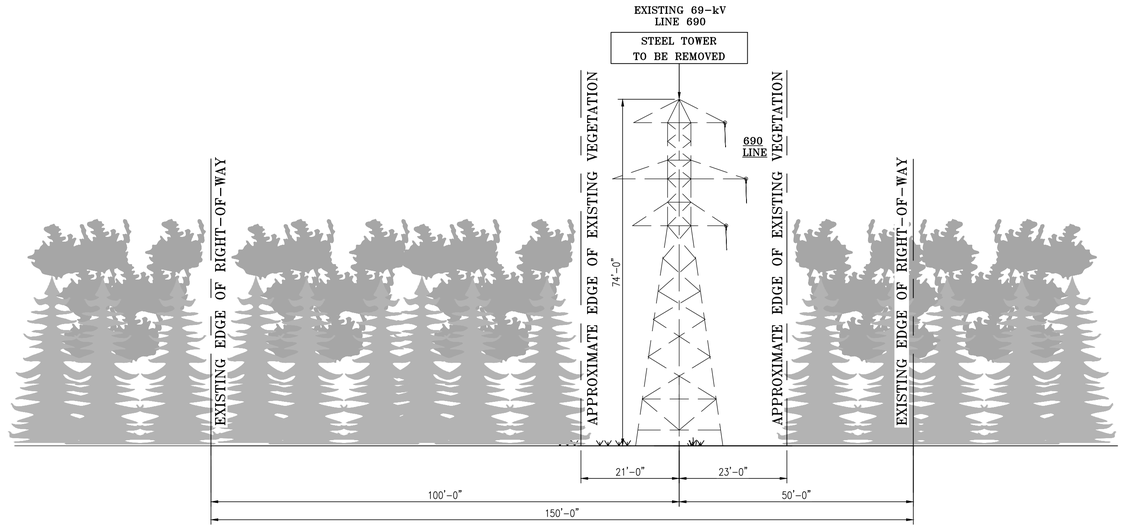
Salisbury and Sharon, CT

Map Sheet 3 of 3

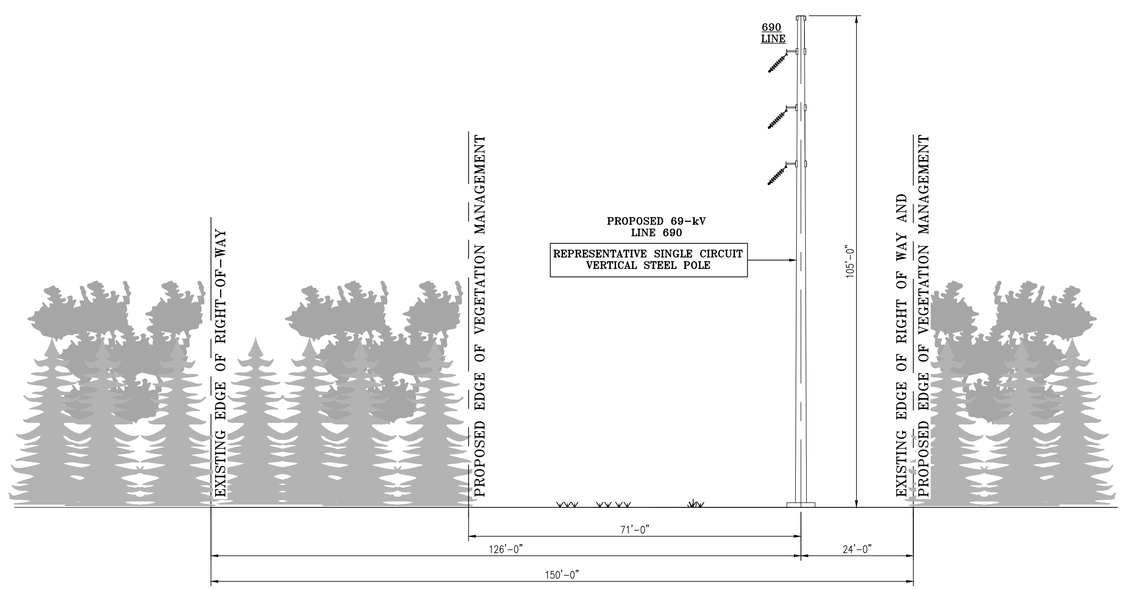
June, 2021

ALL-POINTS TECHNOLOGY CORPORATION

Attachment B: Line 690 – Right-of-Way Cross Section



EXISTING R.O.W. CONFIGURATION
SINGLE CIRCUIT STEEL LATTICE TOWER VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SALISBURY, CT
STR. #1058

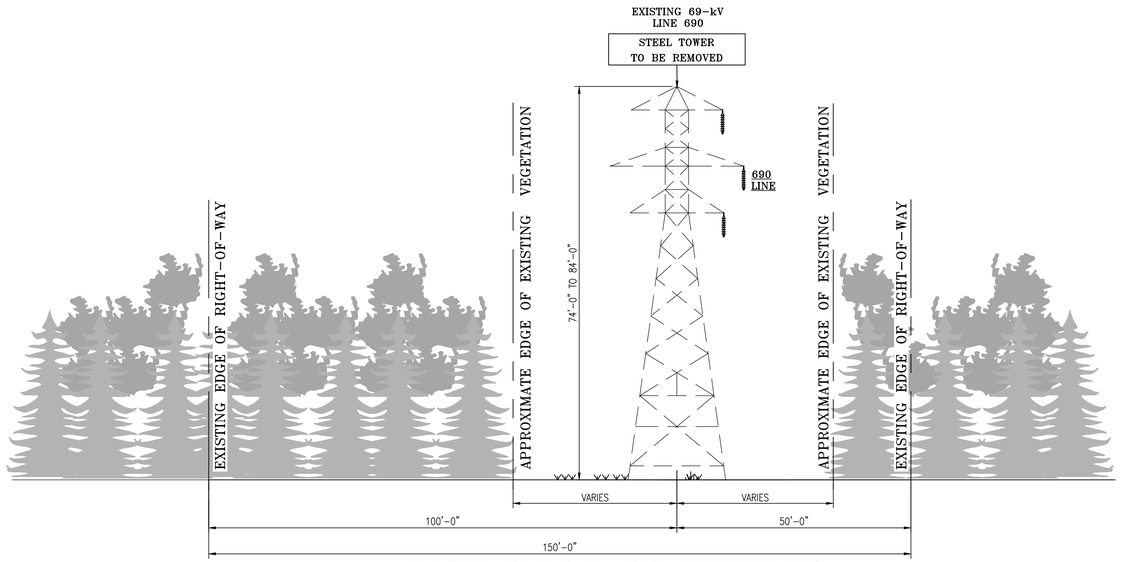


PROPOSED R.O.W. CONFIGURATION
NO ADDITIONAL RIGHT-OF-WAY REQUIRED
SINGLE CIRCUIT STEEL POLE VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SALISBURY, CT
STR. #1058

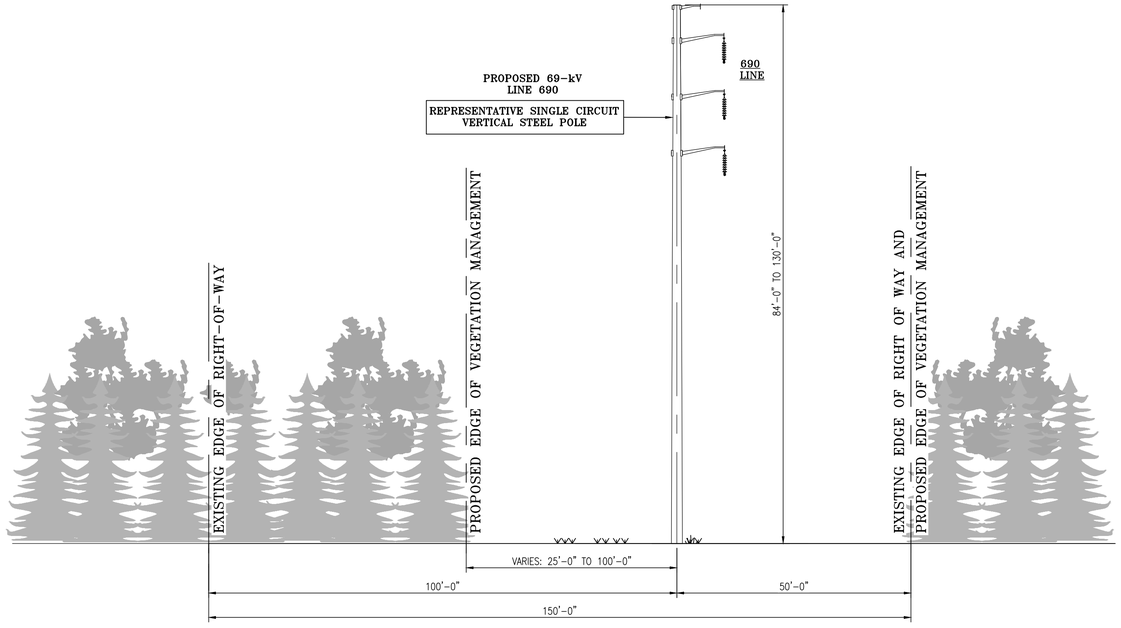
XS-1

EVERSOURCE ENERGY

TITLE: SALISBURY S/S - NY/CT BORDER 69-kV TRANSMISSION LINE R.O.W. CROSS SECTION SALISBURY, CONNECTICUT			
BY: NV5	CHKD: NV5	APP: Designer or P/C	APP: PE
DATE: 04/30/2021	DATE: 04/30/2021	DATE:	DATE:
H-SCALE: N.T.S.	SIZE: D	FIELD BOOK & PAGES:	
V-SCALE: N.T.S.	X.S.	R.E. DWG:	
R.E. PROJ. NUMBER: TMC90601		DWG NO.: 01109-85001p001	



EXISTING R.O.W. CONFIGURATION
SINGLE CIRCUIT STEEL LATTICE TOWER VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SALISBURY/SHARON, CT
0.78 MILES BETWEEN STR. #1053 - STR. #1057, AND STR. #1059 - STR. #1060

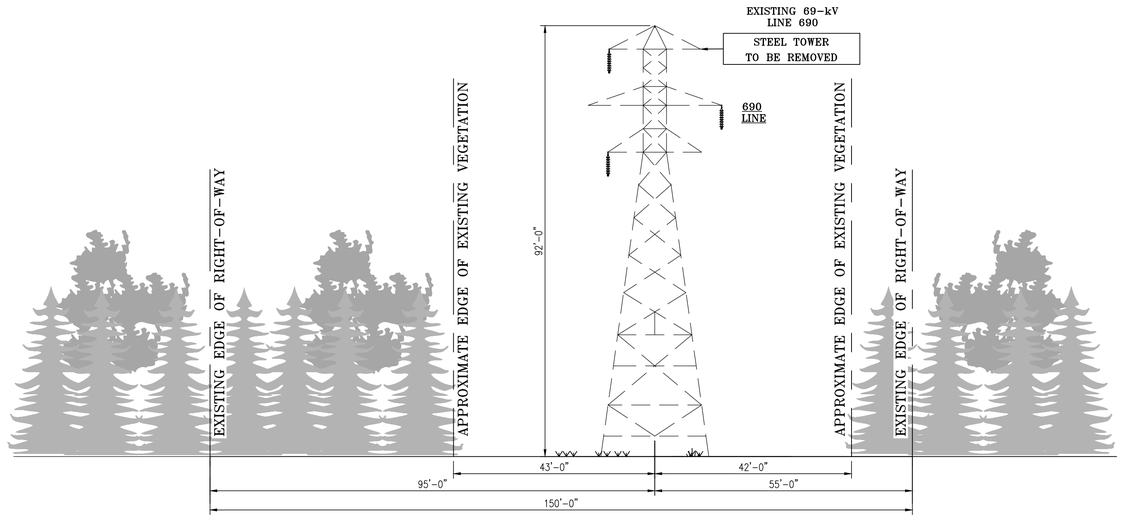


PROPOSED R.O.W. CONFIGURATION
NO ADDITIONAL RIGHT-OF-WAY REQUIRED
SINGLE CIRCUIT STEEL POLE VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SALISBURY/SHARON, CT
0.97 MILES, BETWEEN STR. #1053 - STR. #1057, AND STR. #1059 - STR. #1060

XS-2

EVERSOURCE ENERGY

TITLE	SALISBURY S/S - NY/CT BORDER 69-kV TRANSMISSION LINE R.O.W. CROSS SECTION SALISBURY & SHARON, CONNECTICUT
BY NV5 / CHKD NV5 / APP Designer or P/C / APP PE	
DATE 04/30/2021 / DATE 04/30/2021 / DATE / DATE	
H-SCALE N.T.S. / V-SCALE N.T.S. / SIZE D / V.S.	FIELD BOOK & PAGES / R.E. DWG
R.E. PROJ. NUMBER TMC90601	DWG NO. 01109-85001p002



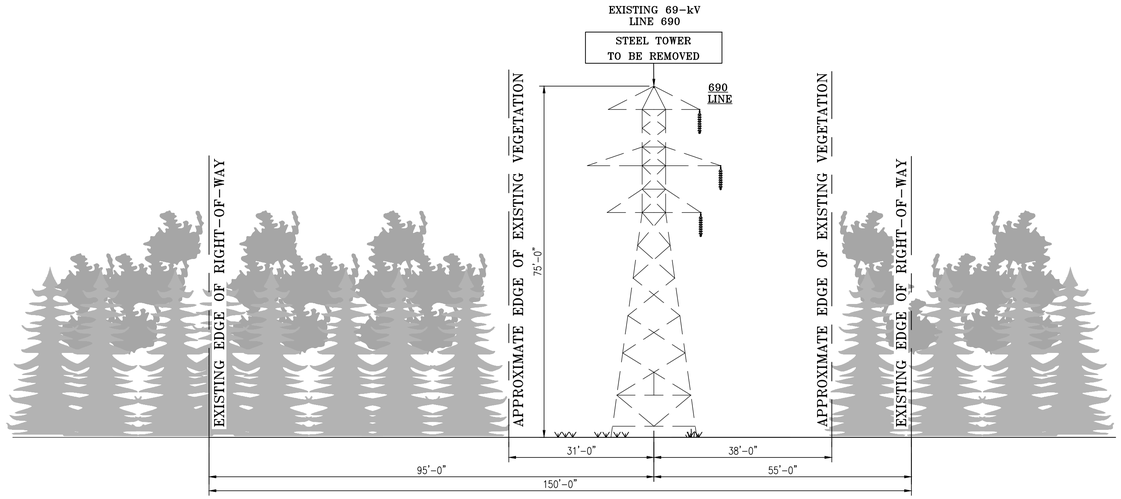
EXISTING R.O.W. CONFIGURATION
SINGLE CIRCUIT STEEL LATTICE TOWER DELTA DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SHARON, CT
STR. #1062

PROPOSED R.O.W. CONFIGURATION
NO ADDITIONAL RIGHT-OF-WAY REQUIRED
SINGLE CIRCUIT STEEL POLE DELTA DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SHARON, CT
STR. #1062

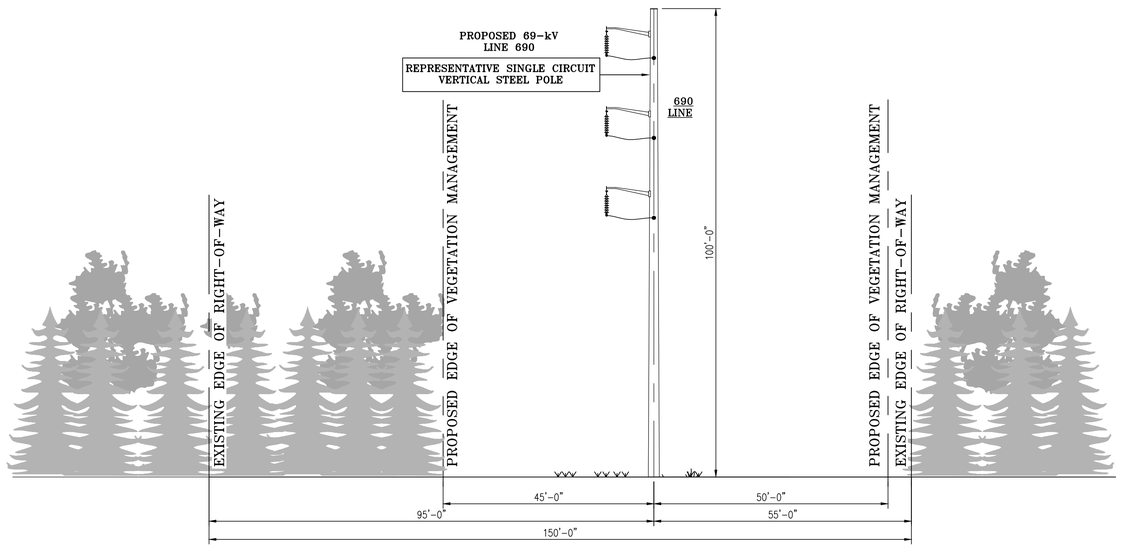
XS-3

EVERSOURCE ENERGY

TITLE: SALISBURY S/S - NY/CT BORDER 69-kV TRANSMISSION LINE R.O.W. CROSS SECTION SHARON, CONNECTICUT			
BY: NV5	CHKD: NV5	APP: Designer or P/C	APP: PE
DATE: 04/30/2021	DATE: 04/30/2021	DATE:	DATE:
H-SCALE: N.T.S.	SIZE: D	FIELD BOOK & PAGES:	
V-SCALE: N.T.S.	V.S.	R.E. DWG:	
R.E. PROJ. NUMBER: TMC90601		DWG NO.: 01109-85001p003	



EXISTING R.O.W. CONFIGURATION
SINGLE CIRCUIT STEEL LATTICE TOWER VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SHARON, CT
STR. #1061

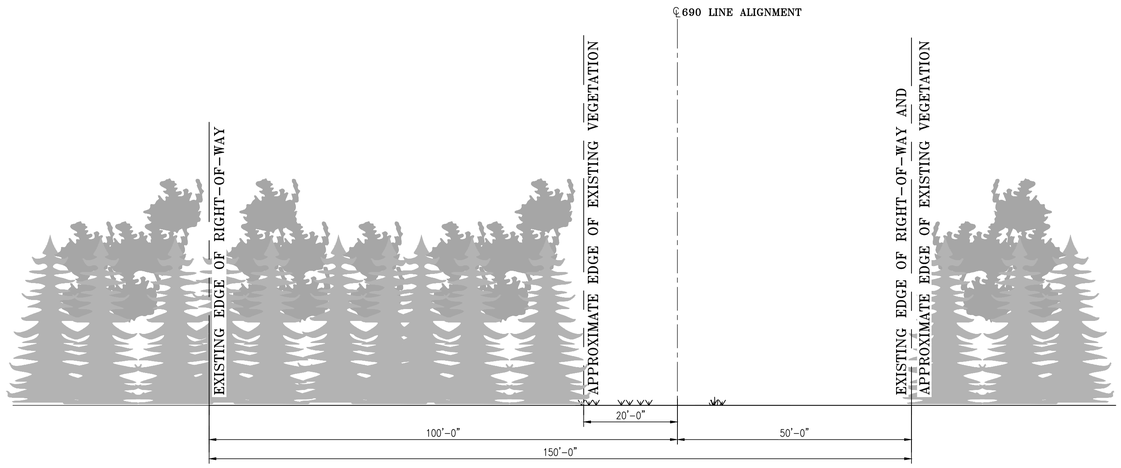


PROPOSED R.O.W. CONFIGURATION
NO ADDITIONAL RIGHT-OF-WAY REQUIRED
SINGLE CIRCUIT STEEL POLE DELTA DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SHARON, CT
STR. #1061

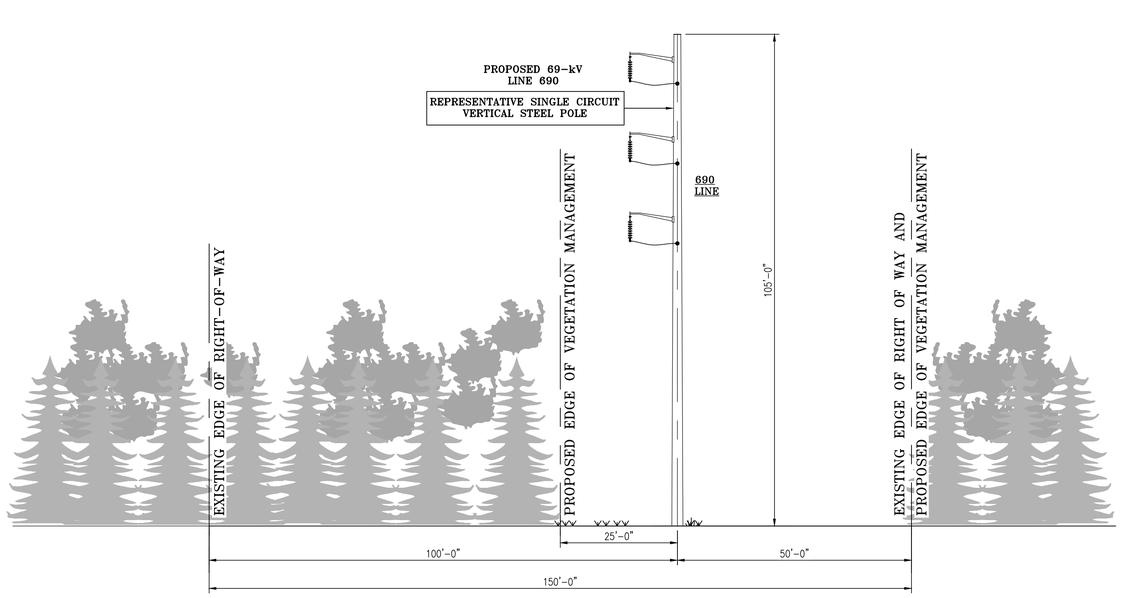
XS-4

EVERSOURCE ENERGY

TITLE: SALISBURY S/S - NY/CT BORDER 69-kV TRANSMISSION LINE R.O.W. CROSS SECTION SHARON, CONNECTICUT			
BY: NV5	CHKD: NV5	APP: Designer or P/C	APP: PE
DATE: 04/30/2021	DATE: 04/30/2021	DATE:	DATE:
H-SCALE: N.T.S.	SIZE: D	FIELD BOOK & PAGES:	
V-SCALE: N.T.S.	V.S.	R.E. DWG:	
R.E. PROJ. NUMBER: TMC90601		DWG NO.: 01109-85001p004	



EXISTING R.O.W. CONFIGURATION
SINGLE CIRCUIT STEEL LATTICE TOWER VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SALISBURY, CT
STR. #1052.5



PROPOSED R.O.W. CONFIGURATION
NO ADDITIONAL RIGHT-OF-WAY REQUIRED
SINGLE CIRCUIT STEEL POLE VERTICAL DESIGN
LOOKING FROM SALISBURY SUBSTATION TO NY/CT BORDER
IN THE TOWN OF SALISBURY, CT
STR. #1052.5

XS-5

EVERSOURCE ENERGY

TITLE: SALISBURY S/S - NY/CT BORDER 69-kV TRANSMISSION LINE R.O.W. CROSS SECTION SALISBURY, CONNECTICUT			
BY: NV5	CHKD: NV5	APP: Designer or P/C	APP: PE
DATE: 04/30/2021	DATE: 04/30/2021	DATE:	DATE:
H-SCALE: N.T.S.	SIZE: D	FIELD BOOK & PAGES:	
V-SCALE: N.T.S.	V.S.:	R.E. DWG:	
R.E. PROJ. NUMBER: TMC90601		DWG NO.: 01109-85001p005	

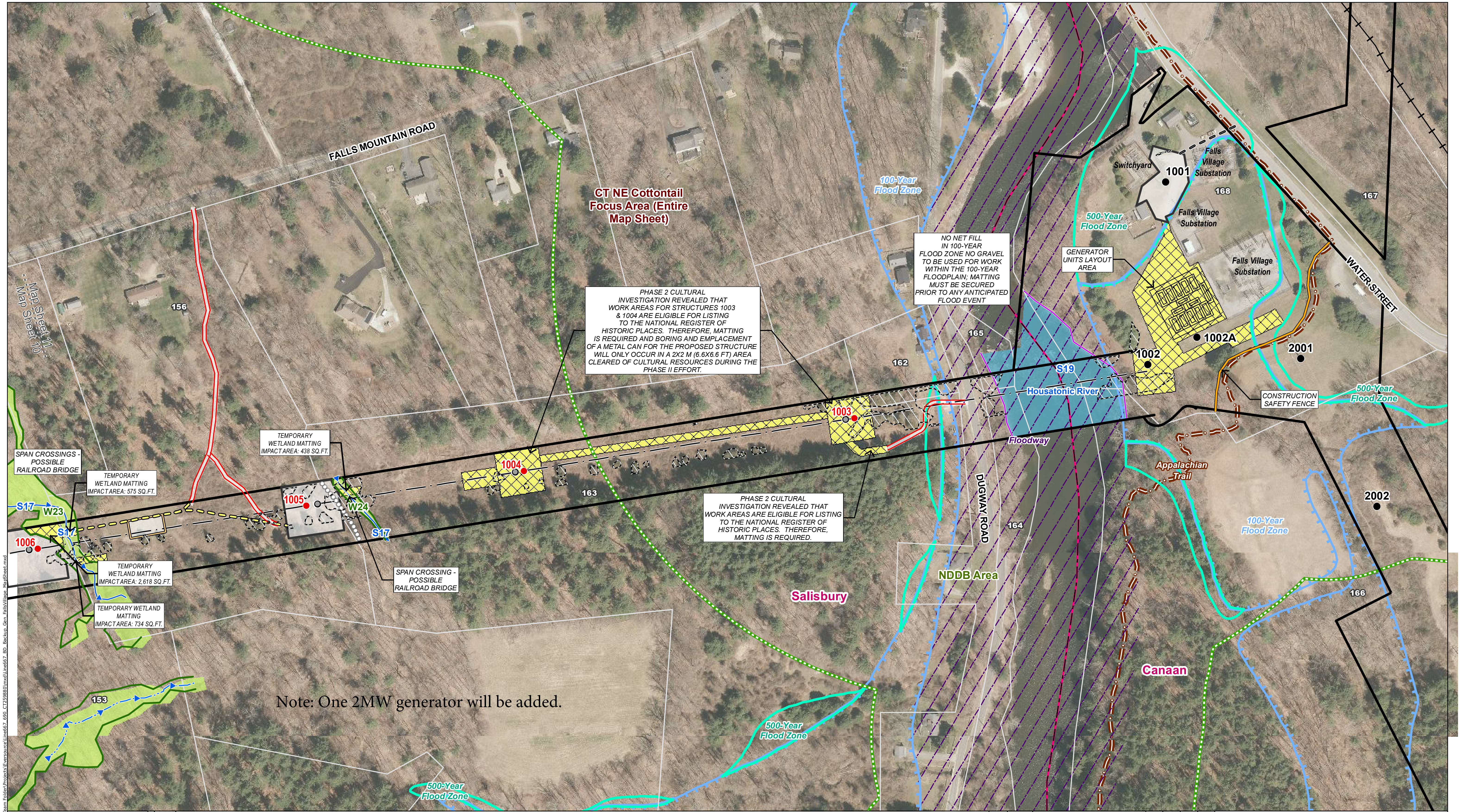
Attachment C: List of Structure Replacements

STRUCTURE	EXISTING 69-kV TYPE	EXISTING 69-kV HEIGHT (FT)	NEW 115-kV TYPE	NEW 115-kV HEIGHT (FT)	HEIGHT CHANGE FROM EXISTING (FT)
Salibury Substation					
1052.5	New Structure	N/A	Monopole	106	N/A
1053	Lattice	82	Monopole	103	21
1054	Lattice	84	Monopole	108	24
1055	Lattice	75	Monopole	84	9
1056	Lattice	74	Monopole	94	20
1057	Lattice	82	Monopole	131	49
1058	Lattice	74	Monopole	106	32
1059	Lattice	84	Monopole	98	14
1060	Lattice	76	Monopole	94	18
1061	Lattice	75	Monopole	101	26
1062	Lattice	92	Monopole	136	44
1063	Lattice	200	N/A	N/A	N/A
Indian Lake					

All replacement structures will be weathering steel.

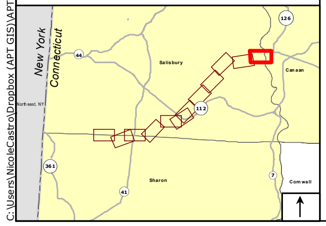
Structure 1063 is not being replaced as part of the Project.

Attachment D: Falls Village Substation – Equipment Layout and Description



FALLS MOUNTAIN ROAD
CT NE Cottontail Focus Area (Entire Map Sheet)
Map Sheet 11 - Map Sheet 10
156
100-Year Flood Zone
500-Year Flood Zone
Switchyard
1001
Falls Village Substation
168
167
Falls Village Substation
Falls Village Substation
WATER STREET
NO NET FILL IN 100-YEAR FLOOD ZONE NO GRAVEL TO BE USED FOR WORK WITHIN THE 100-YEAR FLOODPLAIN; MATTING MUST BE SECURED PRIOR TO ANY ANTICIPATED FLOOD EVENT
GENERATOR UNITS LAYOUT AREA
PHASE 2 CULTURAL INVESTIGATION REVEALED THAT WORK AREAS FOR STRUCTURES 1003 & 1004 ARE ELIGIBLE FOR LISTING TO THE NATIONAL REGISTER OF HISTORIC PLACES. THEREFORE, MATTING IS REQUIRED AND BORING AND EMPLACEMENT OF A METAL CAN FOR THE PROPOSED STRUCTURE WILL ONLY OCCUR IN A 2X2 M (6.6X6.6 FT) AREA CLEARED OF CULTURAL RESOURCES DURING THE PHASE II EFFORT.
165
162
1002
1002A
2001
S19
Housatonic River
CONSTRUCTION SAFETY FENCE
500-Year Flood Zone
1003
Floodway
TEMPORARY WETLAND MATTING IMPACT AREA: 438 SQ.FT.
1004
SPAN CROSSINGS - POSSIBLE RAILROAD BRIDGE
TEMPORARY WETLAND MATTING IMPACT AREA: 575 SQ.FT.
S17
W23
S17
1005
W24
S17
163
Appalachian Trail
PHASE 2 CULTURAL INVESTIGATION REVEALED THAT WORK AREAS ARE ELIGIBLE FOR LISTING TO THE NATIONAL REGISTER OF HISTORIC PLACES. THEREFORE, MATTING IS REQUIRED.
DUGWAY ROAD
164
2002
100-Year Flood Zone
1006
TEMPORARY WETLAND MATTING IMPACT AREA: 2,618 SQ.FT.
SPAN CROSSING - POSSIBLE RAILROAD BRIDGE
NDDB Area
Salisbury
166
TEMPORARY WETLAND MATTING IMPACT AREA: 734 SQ.FT.
Canaan
153
Note: One 2MW generator will be added.
500-Year Flood Zone
500-Year Flood Zone

INDEX MAP



Legend

- Proposed Structure
- Existing Structure
- Existing Structure to be removed
- Existing Right-of-Way (ROW)
- Overhead Eversource Line
- Stone Wall
- Fence
- Construction Safety Fence
- Gate
- Culvert
- Existing Access
- Proposed Access
- Proposed Alternate Access
- Access Road to be Improved
- Temporary Construction Matting
- Stone Work Pad
- Pull Pad
- Clearing Area
- Ordinary High Watermark
- Delineated Perennial Watercourse
- Delineated Intermittent Watercourse
- Drainage Channel
- Confirmed Vernal Pool Extent
- 100' Vernal Pool Envelope
- Delineated Wetland Boundary Outline
- Field Delineated Federal Wetland
- Field Delineated Connecticut Wetland Only
- Open Water
- Critical Habitat Fen
- Critical Habitat (2009)
- Natural Diversity Database Area (June 2020)
- CT New England Cottontail Final Focus Area
- State-Owned Property (none in mapped extent)
- Eversource Owned Property
- Parcel Boundary
- FEMA 100-Year Flood Zone
- 500 Year Flood Zone
- FEMA Floodway
- Appalachian Trail
- Railroad
- Municipal Boundary
- Map Sheet Matchline

Map Notes:
Parcel Boundaries provided by Eversource on 4/17/2017 (not from survey). ROW Boundary provided by Eversource (not from survey). Field Investigation/Data by APT/Davison Environmental.

N

1 inch = 200 feet

0 50 100 200 Feet

NO.	DATE	REVISIONS	BY	CHK	APP	APP

EVERSOURCE ENERGY

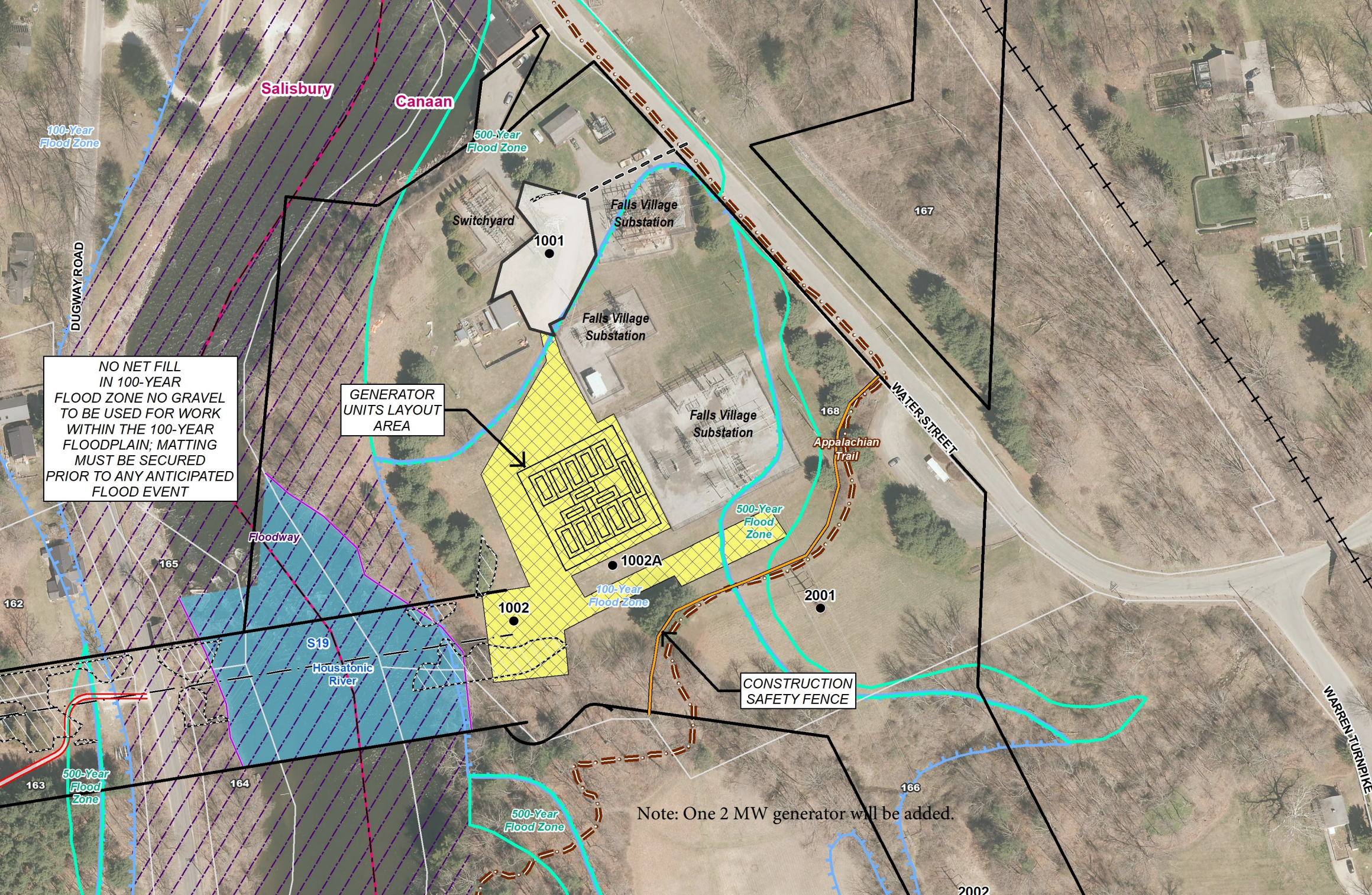
Salisbury Substation to Falls Village Substation 667 Line Reconductoring & Structure Replacement Project

Canaan/Salisbury, CT

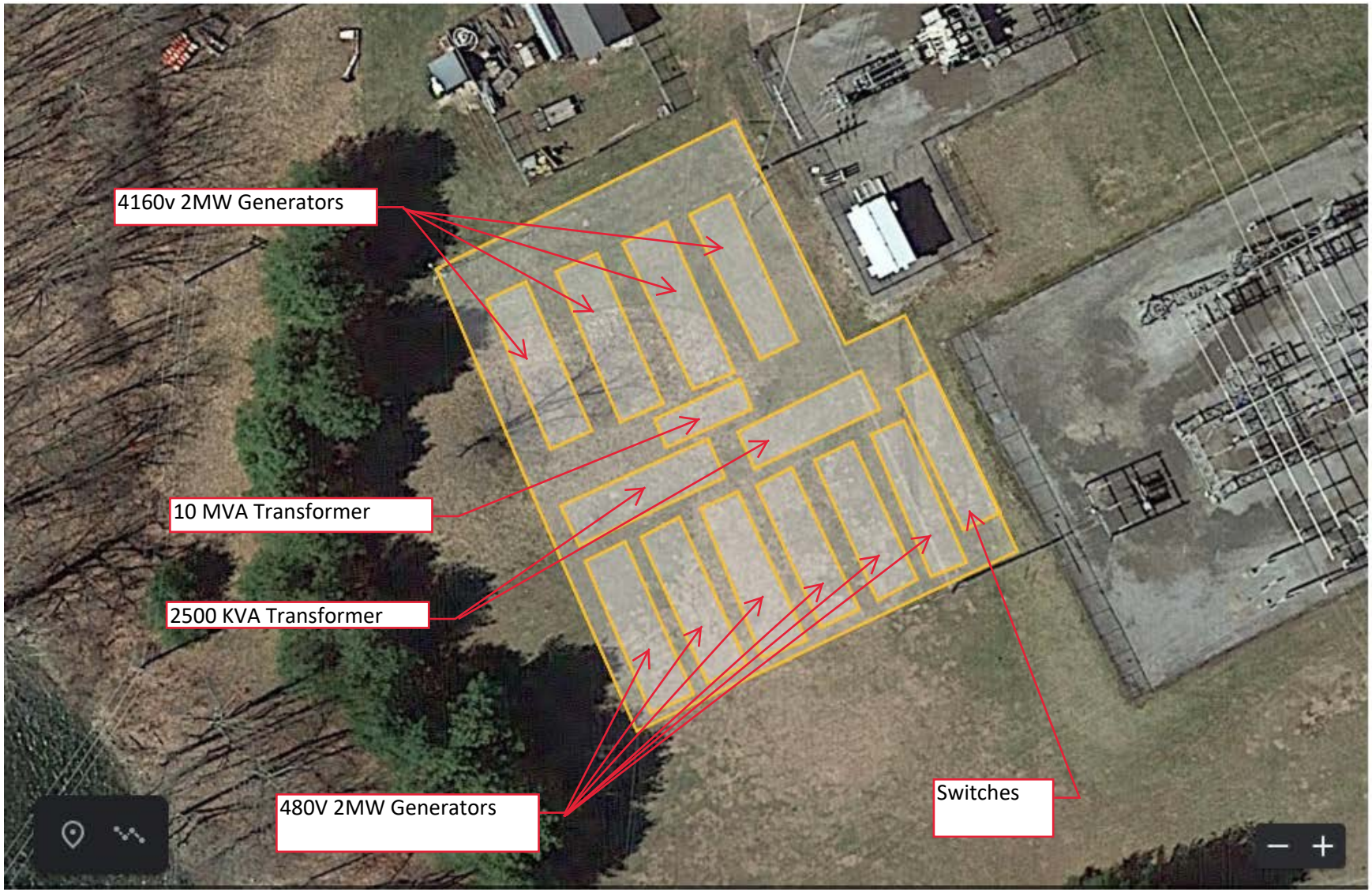
Map Sheet 11 of 11

August, 2020

ALL-POINTS TECHNOLOGY CORPORATION



Note: One 2 MW generator will be added.



Note: One 2MW generator will be added.

XQ2000 RENTAL

CATERPILLAR®

Image shown may not reflect actual package

STANDBY 2000 kW
PRIME 1825 kW
POWER MODULE
50/60 Hz

Frequency	Voltage	Standby kW (kVA)	Prime kW (kVA)
60	480/277V	2000 (2500)	1825 (2281)
50	400V	1440 (1800)	1310 (1638)

FEATURES

EPA TIER 2 and CARB certified for non-road mobile applications. Factory designed, certified prototype tested with torsional analysis. Production tested and delivered in a package that is ready to be connected to your fuel and power lines. Supported 100% by your Caterpillar® dealer with warranty on parts and labor. Extended warranty available in some areas. The generator set is designed and manufactured in an ISO 9001:2000 compliant facility. Generator set and components meet or exceed the following specifications: AS1359, AS2789, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO3046/1, ISO8528, NEMA MG1-22

CATERPILLAR SR4B GENERATOR

Single bearing, wye-connected, static regulated, brushless permanent magnet excited generator designed to match the performance and output characteristics of the Caterpillar diesel engine driving it.

RELIABLE, FUEL EFFICIENT DIESEL ENGINE

The compact, four-stroke-cycle diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.

CATERPILLAR COOLING SYSTEM

Sized compatible to rating with energy efficient fan and core.

CATERPILLAR SWITCHGEAR

Provides single unit and/or multi-unit/utility paralleling components. Standby, load sense/load demand, import, export, and base load modes. Comes standard with Basler Utility Multi-function Relay IPS-100.

EXCLUSIVE CATERPILLAR DIGITAL VOLTAGE REGULATOR (CDVR)

Three-phase sensing and adjustable Volts-per-Hertz regulation give precise control, excellent block loading, and constant voltage in the normal operating range.

ENVIRONMENTALLY FRIENDLY

110% spill containment of onboard engine fluids.

SOUND ATTENUATED CONTAINER

For ease of transportation and protection. Meets 75 dB(A) at 50 ft or below per SAE J1074 measurement procedure at 110% prime load.

FACTORY INSTALLED STANDARD EQUIPMENT

SYSTEM	STANDARD EQUIPMENT
Engine	EPA approved Tier 2 3516C Caterpillar engine Heavy duty air cleaner with service indicator 60-Amp charging alternator Fuel filters – primary and duplex secondary with integral water separator and change-over valve Lubricating oil system with spin-on, full flow oil filters and water cooled oil cooler Oil drain lines routed to engine rail Jacket water heater Fuel cooler and priming pump Electronic ADEM™ A3 controls 24V electric starting motors with battery rack and cables
Generator	SR-4B brushless, permanent magnet excited, three-phase with Caterpillar digital voltage regulator (CDVR), space heater, 6-lead design, Class H insulation operating at Class F temperature for extended life, winding temperature detectors and anti-condensation space heaters (120/240V 1.2 kW)
Containerized Module	40' ISO high cube container, CSC certified 3-axle, 40' ISO container chassis Seven (7) sound attenuated air intake louvers and 4 lockable personnel doors with panic release Side bus bar access door, external access load connection bus bars Shore power connection via distribution block connections for jacket water heater, battery charger, space heaters, and generator condensate heaters Standard lighting 3 AC/4 DC, one (1) single duplex service receptacle, 2 external break-glass emergency stop push buttons 1,250 gal fuel tank, UL listed, double wall, 9 hr runtime @ prime rating Sound attenuated 75 dB(A) @ 50 ft Spill containment 110% of all engine fluids Four (4) oversized maintenance-free batteries, battery rack and 20-Amp battery charger Hospital grade, internally insulated, rectangular exhaust silencer with vertical discharge Vibration isolators, corrosion resistant hardware and hinges External drain access to standard fluids Fire extinguishers (Qty 2) Standard Cat rental decals and painted standard Cat power module white Interior walls and ceilings insulated with 100 mm of acoustic paneling Floor of container insulated with acoustic glass and covered with galvanized steel
Cooling	Standard cooling provides 43° C ambient capability (60 Hz) at prime +10% rating Vertically mounted, separate ATAAC and JW cores with vertical air discharge
Generator Paralleling Control	Custom switchgear control with EMCP 3.3 genset mounted controller and wall mounted paralleling controls Automatic start/stop with cool down timer Protections: 25, 27/59, 40, 32, 81 O/U Utility multi-function relay protections: 25,27/59, 32, 47, 50/51, 62, 67, 81 O/U UMR is IEEE1547-2003 compliant in most applications Reverse compatibility module provided for interface to legacy power modules Touch screen controls with event log Multi-mode operation (island, multi-island and utility parallel), load sharing (multi-unit only) Import & export control (utility parallel only), manual and automatic paralleling capability Touch screen display (status and alarms) Metering display: voltage, current, frequency, power factor, kW, WHM, kVAR, and synchroscope
Quality	Standard genset and package factory tested UL, NEMA, ISO and IEEE standards O&M manuals

SPECIFICATIONS

CAT SR4B GENERATOR

Frame Size 825
Pitch 0.6667
No. of poles 4
Excitation ..... Static regulated brushless PM excited
Constructions ..... Single bearing, close coupled
Insulation ..... Class H
Enclosure ..... Drip proof IP22
Alignment ..... Pilot shaft
Overspeed capability – % of rated ..... 125% of rated
Voltage regulator ..... 3 phase sensing with Volts-per-Hertz
Voltage regulation ..... Less than ± ½% voltage gain
Adjustable to compensate for engine speed droop and line loss
Wave form deviation ..... Less than 5% deviation
Telephone Influence Factor (TIF) ..... Less than 50
Harmonic Distortion (THD) ..... Less than 5%

CAT 3516C DIESEL ENGINE

3516C, 4-Stroke diesel
Bore – mm (in) 170 (6.7)
Stroke – mm (in) 190 (7.5)
Displacement – L (cu in) 69 (4,210)
Compression ratio 15:1
Aspiration ..... ATAAC
Fuel system ..... EUI
Governor type ..... Caterpillar ADEM™ A3 Control System

TECHNICAL DATA

Materials and specifications are subject to change without notice.

Generator Set Technical Data		50 Hz		60 Hz	
	Units	Prime	Standby	Prime	Standby
Performance Specification		DM8754		DM8264	
Power Rating	kW (kVA)	1310 (1637)	1440 (1800)	1825 (2281)	2000 (2500)
Lubricating System					
Oil pan capacity	L (gal)	401.3 (106)		401.3 (106)	
Fuel System					
Fuel Consumption					
100% load	L (gal)	350.1 (92.5)	372.9 (98.5)	483.2 (127.6)	525.7 (138.9)
75% load	L (gal)	281.9 (74.5)	302.8 (80)	380 (100.4)	408.2 (107.8)
50% load	L (gal)	205.5 (54.3)	350.1 (92.4)	270.5 (71.5)	294.2 (77.7)
Fuel tank capacity	L (gal)	4731 (1,250)		4731 (1,250)	
Running time @ 75% rating	Hours	16.7	15.6	12.5	11.5
Cooling System					
Radiator coolant capacity including engine	L (gal)	630 (166)		630 (166)	
Air Requirements					
Combustion air flow	m^3/min (cfm)	114.8 (4052)	118.1 (4173)	174.7 (6169)	180.3 (6367)
Maximum air cleaner restriction	kPa (in H_2O)	6.2 (24.9)		6.2 (24.9)	
Generator cooling air	m^3/min (cfm)	140 (5,933)		168 (4,995)	
Exhaust System					
Exhaust flow at rated kW	m^3/min (cfm)	311.3 (10,993)	320.8 (11,335)	404 (14,260)	428.6 (15,137)
Exhaust stack temperature at rated kW – dry exhaust	°C (°F)	502.1 (935.8)	513.1 (955.6)	387 (728)	405 (762)
Noise Rating (with enclosure)					
@ 7 meters (23 feet)	dB(A)	77	78	78	79
@15 meters (50 feet)	dB(A)	73	74	74	75

Model	Length mm (in)	Width mm (in)	Height mm (in)	Weight	
				With Lube Oil and Coolant kg (lb)	With Fuel, Lube Oil and Coolant kg (lb)
XQ2000 w/o Chassis	12 192 (480)	2438 (96)	2896 (114)	34 019 (75,000)	38 102 (84,000)
XQ2000 w/Chassis	12 192 (480)	2438 (96)	4267 (168)	38 102 (84,000)	42 184 (93,000)

RATING DEFINITIONS

Standby – Applicable for supplying continuous electrical power (at variable load) in the event of a utility power failure. No overload is permitted on these ratings. The generator on the generator set is peak prime rated (as defined in ISO8528-3) at 30° C (86° F).

Prime – Applicable for supplying continuous electrical power (at variable load) in lieu of commercially purchased power. There is no limitation to the annual hours of operation and the generator set can supply 10% overload power for 1 hour in 12 hours.

STANDARD FEATURES

GENERATOR SET EMCP 3.3 LOCAL CONTROL PANEL

- Generator mounted EMCP 3.3 provides power metering, protective relaying and engine and generator control and monitoring.
- Provides MODBUS datalink to paralleling control for monitoring of engine parameters.
- Convenient service access for Caterpillar service tools (not included).
- Integration with the CDVR provides enhanced system monitoring.
- Ability to view and reset diagnostics of all controls networked on J1939 datalink.
- Network modules via the control panel removes the need for a separate service tool for troubleshooting.
- Real-time clock allows for date and time stamping of diagnostics and events.

EMCP 3.3 ENGINE OPERATOR INTERFACE

- Graphical display with positive image, transflective LCD, adjustable white backlight/ contrast.
- Two LED status indicators (1 red, 1 amber).
- Three engine control keys and status indicators (Run/Auto/Stop).
- Lamp test key.
- Alarm acknowledgement key.
- Display navigation keys.
- Two shortcut keys: Engine Operating Parameters and Generator Operating Parameters.
- Fuel level monitoring and control.

CIRCUIT BREAKER

- 3000A fixed type, 3 poles, genset mounted, electrically operated, insulated case circuit breaker.
- Solid state trip unit for overload (time overcurrent) and fault (instantaneous) overcurrent protection.
- Includes DC shunt trip coil activated on any monitored engine or electrical fault, 100 KA-interrupting capacity at 480 VAC.

VOLTAGE REGULATION AND POWER FACTOR CONTROL CIRCUITRY

- Generator mounted automatic voltage regulator, microprocessor based.
- Manual raise/lower voltage adjust capability and VAR/power factor control circuitry for maintaining constant generator power factor while paralleled with the utility.
- Includes RFI suppression, exciter limiter and exciter diode monitoring.
- Voltage and power factor adjustments are performed on the setting screen of the HMI touch screen.

FUEL TANK

- UL Listed 1250 gallon double walled.
- Fuel transfer system

CURRENT TRANSFORMERS

- CT's rated 3000:5 with secondaries wired to shorting terminal strips.

POTENTIAL TRANSFORMERS

- 4:1 ratio with primary and secondary fuse protection.

BUS BARS

- Three phase, plus full rated neutral, bus bars are tin-plated copper with NEMA standard hole pattern for connection of customer load cables and generator cables.
- Bus bars are sized for full load capacity of the generator set at 0.8 power factor.
- Includes ground bus, tin-plated copper, for connection to the generator frame ground and field ground cable.

AC DISTRIBUTION

- Provides 240 VAC for all module accessories.
- Includes controls to de-energize jacket water heaters and generator space heater when the engine is running.

SHORE POWER TWO (2)

- One (1) shore power connection distribution block for jacket water heaters.
- One (1) for generator space, battery charger, and fuel pump.

INTERNAL LIGHTING

- Four (4) internal DC lights with one (1) timer and two switches installed at each side of the container door.
- Three (3) internal AC lights.
- One (1) single duplex service receptacle.

BATTERY CHARGER AND BATTERIES

- 24 VDC/20A battery charger with float/equalize modes and charging ammeter.
- Maintenance free batteries.

EMERGENCY STOP PUSHBUTTON

- Two external ESPs located near each access door.

MODES OF OPERATION

Caterpillar utility paralleling controls are intended for automatic or manual paralleling with a utility power source as a load management system, with provisions for standby operation feeding an isolated load network. Load management operation involves microprocessor-based automatic loading controls with soft loading, base load, Import/Export control and soft unloading. For Standby operation, the generator operates as an isochronous machine isolated from the utility supply. The controls allow for automatic operation, initiated locally or remotely by the customer's SCADA system. Detailed modes of operation are listed below:

SINGLE UNIT ISLAND AND MULTI-UNIT ISLAND OPERATION

1. Utility Standby Mode (Normal)
   a. The utility is providing power for the plant loads.
   b. The Power Module Generator breaker is open.
   c. The pm is in automatic standby mode to respond to a utility failure.
2. Emergency Mode (Emergency)
   a. Utility Failure
      1) The customer protective relaying senses a utility abnormal condition.
      2) A run request is sent to the Power Module Generator plant.
      3) The first Power Module Generator reach rated to voltage and frequency is closed to the bus.
      4) In Multi-Unit Island Mode, the remaining Power Module Generators are paralleled to the bus as they reach rated voltage and frequency. This function is performed via the ModBus Plus data link connected between the Power Modules.
      5) Plant load is transferred to the Power Modules, which share load equally via ModBus Plus data link.
      6) The system is now in Emergency Mode.

GENERATOR DEMAND PRIORITY CONTROL

The System Controls include a Generator Demand Priority Control function to automatically match the on-line Power Module Generator capacity to the loads in order to avoid unnecessary operation of all the Power Module Generators when the plant loads are low.

The following controls are provided for each Power Module Generator:

a. User-settable Generator Priority Selector
b. Status indicator for the Generator Priority selected
c. Status indicator for Power Module Generator on-line or off-line
d. Generator Demand Priority Control Switch (On/Off)
e. User-settable Generator Remove Level (% as a function of single generator capacity)
f. User-settable Generator Remove Time Delay
g. User-settable Generator Add Level (% as a function of single generator capacity)
h. User-settable Generator Add Time Delay

Upon entrance into Emergency Mode, all generators will be started and paralleled to the bus. After the Remove Time Delay, Power Module Generators will be removed from the bus as a function of the generator percentage loading. Generators will be removed from the bus in descending priority order.

Should the generator percentage loading increase to the user-selected Generator Add Level after the user-selected Generator Add Time Delay, the next priority generator will be started, synchronized and paralleled to the bus. Should the Power Module Generator plant ever reach 100% loading, the next priority generator will be started and added to the bus, bypassing the Generator Add Time Delay.

MODES OF OPERATION (continued)

SINGLE UNIT IMPORT, EXPORT OR BASE LOAD OPERATION

During periods of peak demand the system may be placed in operation using the operator interface panel on the front of the switchgear.

1. Entry – Local
   a. The operator places the System Control Switch into Load Management.
   b. The operator selects Import, Export or Base Load Operation.
   c. The Load Management Setpoint is the amount of power Imported, Exported or Base-Loaded. A 4-12-20mA signal is provided by the customer and is linearly proportional to the utility load, with 12mA equaling 0 kW. The 4-12-20mA utility load signal is wired to one and only one Power Module. If the Power Module selected for Load Management is not available, the 4-12-20mA signal will be routed to a different Power Module.
   d. The operator sets the Load Management Setpoint and Power Factor Setpoint.
   e. A Run request signal is received by the Single Unit Power Module.
   f. The Power Module Generator is started and will run for a predetermined warm-up time before it is synchronized and paralleled to the utility.
   g. When the generator is on the bus, it is soft-ramp-loaded until the generator output reaches the Load Management Setpoint.
   h. The generator output is dynamically adjusted to maintain the Load Management Setpoint.
   i. Should the utility fail during Load Management Operation, the Protective Relay will cause the Paralleling Circuit Breaker 52G to open and be locked out until the Lockout Relay is manually reset by an operator on site. The generator is allowed to run for the duration of the cooldown time.
2. Exit – Local
   a. The Run Request signal is removed from the power module.
   b. The generator is soft-ramp-unloaded until the plant load is fully supported by the utility.
   c. The Paralleling Circuit Breaker 52G is opened.
   d. The generator is allowed to run for the duration of the cooldown time.

STANDARD PARALLELING CONTROL

GENERATOR PARALLELING CONTROLS

The switchgear includes:

- Single unit island mode.
- Multiple unit island mode.
  - Includes Load Sense/Load Demand control.
  - Load sharing capability is provided via network communication.
- Single unit utility parallel mode.
  Selectable for Import/Export control.
  If import or export control is selected a 4-12-20mA signal is required (provided by others) scalable to the utility contribution.
- 6 inch black and white HMI touch screen.
- Reverse compatibility module provided for interface to legacy designed Power Module Switchgear. Includes PLC, load share and voltage droop.

Incoming Utility Breaker Status Circuit – Circuit to accept customers contact from remote utility disconnect device. Customer to provide a normally open form 'a' contact to indicate when the local load network is connected to the utility grid.

Utility Transfer Trip Circuit – Circuit accepts input (normally open dry contact) from customer's system protective relay(s) or other controlling device. Operation of contacts causes tripping of the generator circuit breaker via the generator (software) 86 lock-out function and places the engine in cooldown mode. Circuit is disabled when operating in single unit or multiple unit island.

GENERATOR PARALLELING CONTROLS OPERATOR INTERFACE

Graphical mimic one line diagram that shows generator with its respective circuit breaker in a one-line representation of the system. The graphics utilize black and white indicators and bar graphs while actively displaying the following information:

- Utility CB Open/Closed. Input contacts provided by others.
- Utility kW 4-12-20mA signal required and provided by customer that is scalable to the utility contribution.
- Generator CB Open/Closed/Tripped.
- Generator Volts/Amps/kW/Frequency.
- Engine Stopped/Running/Cooldown/Pre-Alarm/Shutdown.
- Engine ECS Position Stop/Auto/Run.
- Utility Output kW.
- System Summary Alarm.

Event logging is also included with up to 500 stored events.

GENERATOR METERING AND PROTECTION

Generator metering that will graphically display 3Ø Voltage, 3Ø Current, Frequency, Power Factor, kW, kVAR and a Synchroscope Display of EMCP 3.3 faults, CDVR or ADEM 3 will be provided via Modbus RTU interface to EMCP 3.3.

Generator/Intertie Protective Relaying including:

- Device 27/59 – Under/Over Voltage.
- Device 81O/U – Under/Over Frequency.
- Device 40 – Loss of Excitation.
- Device 32 – Reverse Power.
- Device 25 – Synchronizing Check.
- Device 15 – Auto Synchronizer.
- Device 65 – Governor Load Sharing, Soft Loading Control.
- Device 90 – VAR/PF and Cross Current Compensation Controller.

PROGRAMMING AND DIAGNOSTICS

Includes field programmable set points for engine control and monitoring variables and self-diagnosis of the EMCP 3.3 system component and wiring failures.

ENGINE CONTROL SWITCH

Keypad selectable, four (4) positions – Off, Auto, Man, Cool:

- Off for engine shutdown and resetting faults.
- Auto for local or remote automatic operation when initiated by switch operation or contact closure.
- Man for local starting and manual paralleling.
- Cool for normal engine shutdown with timed cool-down cycle.

CIRCUIT BREAKER CONTROL SWITCH

Heavy duty, three- (3) position spring return to center with momentary trip and close position and slip contacts for automatic closing. Includes circuit breaker position indicating lamps.

EMERGENCY STOP PUSHBUTTON

- Mushroom head, twist to reset, causes engine shutdown and tripping of the generator circuit breaker. Prevents engine starting when depressed.

STANDARD PARALLELING CONTROL (continued)

ELECTRONIC LOAD SHARING GOVERNOR

- Includes speed adjustment, and auto load share capability when in parallel with legacy power modules.

ALARM MODULE

- Dedicates annunciator screens for warning and shutdown faults. Includes external mounted horn and acknowledge push-button.

AUTOMATIC/MANUAL PARALLELING

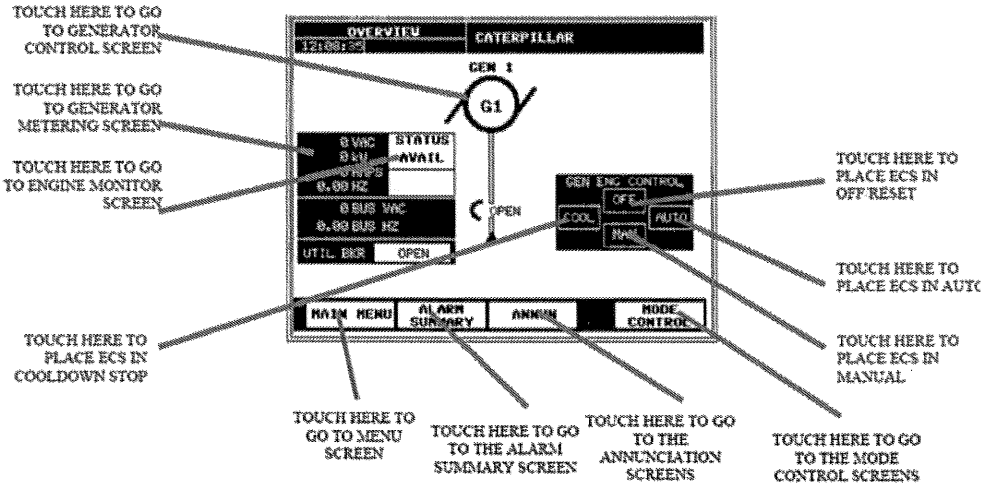
- Automatically synchronizes and parallels the generator with another power source.
- Includes provisions for manual permissive paralleling.

HUMAN MACHINE INTERFACE (HMI) HIGHLIGHTS

- Engine/Generator function is performed thru the 6" HMI touch screen interface.

Overview Screen (Typical)

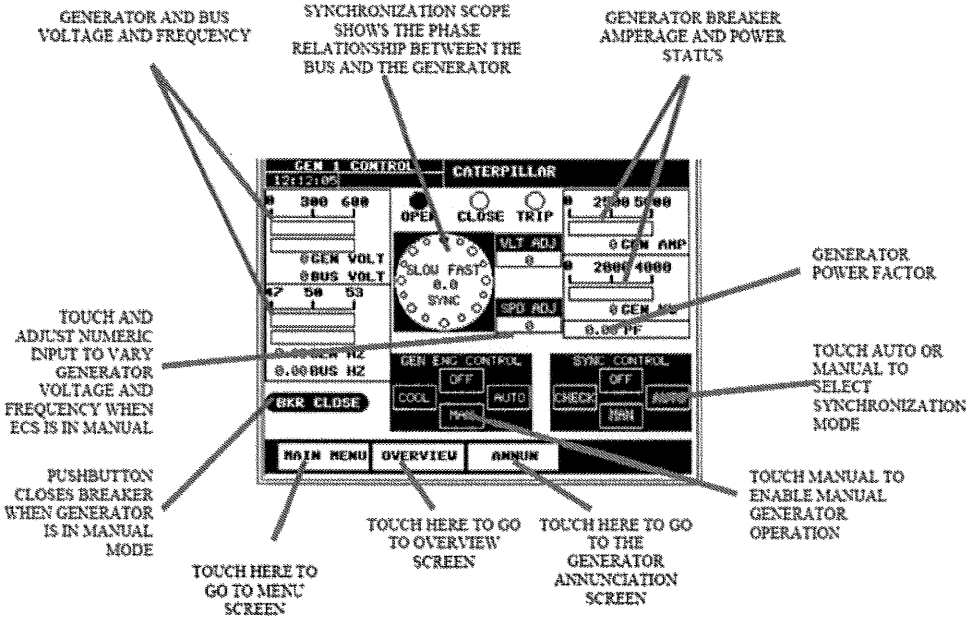
Shows the generator status, generator metering data, bus metering data, ECS position, and generator/utility breaker status.



STANDARD PARALLELING CONTROL (continued)

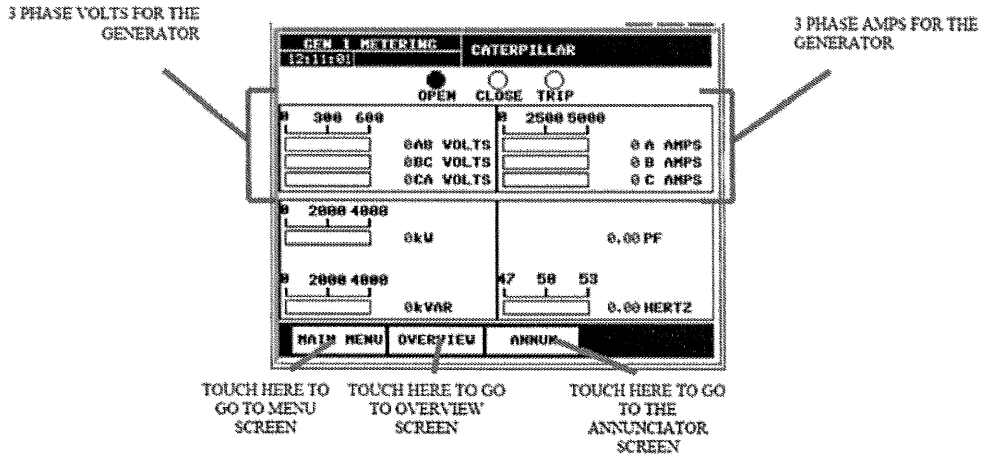
Generator Control Screen (Typical)

It allows the operator to observe the automatic synchronization and transfer of the load to and from the generator. Engine control allows the operator to run the engine in manual, or switch to automatic modes. Voltage and frequency offset adjustment allows the operator to control generator frequency and voltage.



Generator Metering Screen (Typical)

Allows the operator to view three phases of voltage and amperage for the bus and the generator.

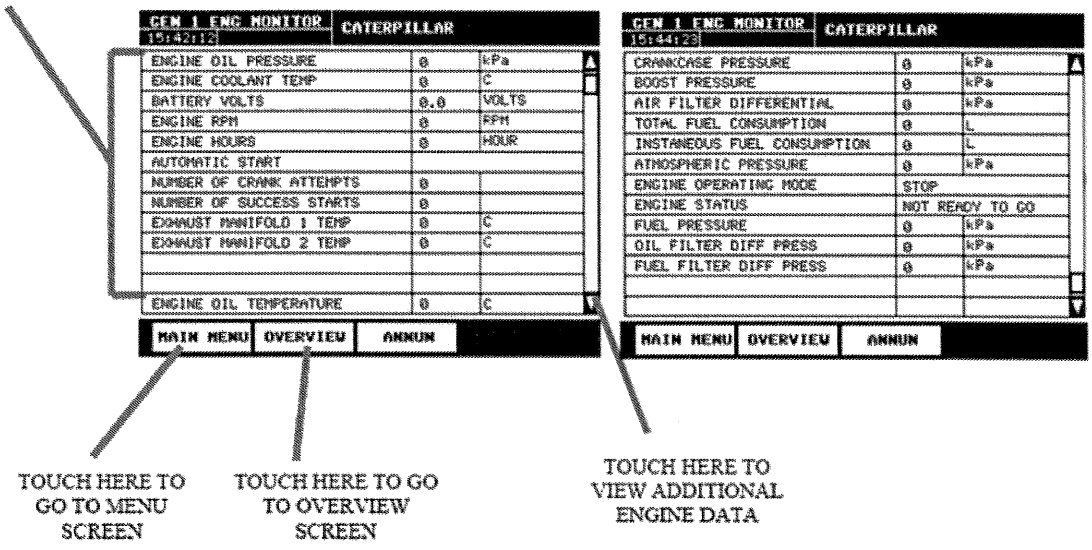


STANDARD PARALLELING CONTROL (continued)

Engine Monitoring Screen (Typical)

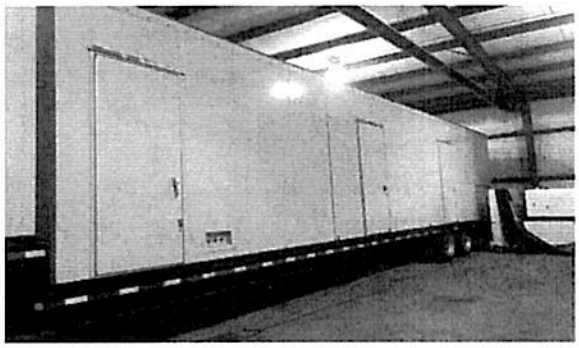
Engine status is obtained directly from the EMCP 3. Engine starts and total hours can be used by the operator to determine when regular preventive maintenance is required. Other metering includes engine battery and oil filter health.

EMCP 3.3 ENGINE DATA



SUNBELT RENTALS
PUMP & POWER SERVICES

MTU 2000 KW Portable Diesel Generator Sets



We are excited to announce that Power and HVAC has added (6) 2 MW 4160 Volt Power Modules to our fleet!! The addition of these units represents a unique product offering for your customers! Very quickly you can supply 4160 or 2400 volts to your customers without the need for a step-up transformer and all the 480 volt 4/0 Cabling. With only 4 cables you can provide your customer 2 MW worth of power. These machines are ideal for utility, industrial, and municipal customers looking for medium voltage power for prime power, standby, or peak shaving applications. They will parallel with our existing fleet of generators and will add a very valuable tool to your tool box!

Product Details

- MTU 16V400 diesel engines with less than 1000 hours each
  - Packaged by Enercon
- Beckwith Generator Protection Relay
- Generator end rated at 4160V or 2400 V 3Ph 60HZ
- Detroit/MTU Digital controls
- Generator Operator Modes
  - Peak Shaving
  - Standalone / Island
  - Multiple Generator (Parallel)
- Operator control room with paralleling gear and engine controls separate from generator enclosure. Provides a safe and quiet room for operator.
- 53' portable sound attenuated weather protective enclosure
- Critical exhaust silencer
- New 24V starting batteries with rack and cables
- Dual Battery chargers
- Engine coolant heaters with circulation pumps
- No transformer needed for quick deployment!!
- 1350 Gallon Fuel Tank with Racor change on the fly fuel filtration system
- Extremely quiet!
- These machines are also great for long cable runs where you can run 1 per phase 4/0 Type SH (shielded) power cable then put a transformer to step the voltage down to 480 V / 208 V.
- Each machine will have 100' of 4/0 Type SH Portable Power Cable on board!

SUNBELT.
RENTALS
PUMP & POWER
SERVICES

Model: 2500REOZD

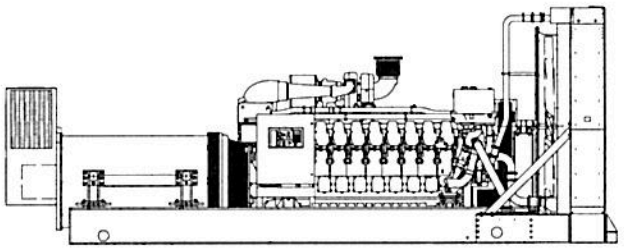
KOHLER POWER SYSTEMS

380V-13.8kV Diesel

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

Ratings Range

		60 Hz	50 Hz
Standby:	kW	2500	2240
	kVA	3125	2800
Prime:	kW	2250-2270	2000
	kVA	2813-2838	2500



Standard Features

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set offers a UL 2200 listing.
- At 60 Hz, the generator set accepts rated load in one step.
- The 60 Hz generator set meets NFPA 110, Level 1, when equipped with the necessary accessories and installed per NFPA standards.
- The generator set complies with ISO 8528-5, Class G3, requirements for transient performance.
- A one-year limited warranty covers all systems and components.
- Alternator features:
  - The pilot-excited, permanent-magnet (PM) alternator provides superior short-circuit capability.
  - The brushless, rotating-field alternator has broadrange reconnectability.
- Other features:
  - The generator set is direct-mounted to the skid.
  - Electronic engine controls manage the engine.

Generator Set Ratings

				130°C Rise Standby Rating		105°C Rise Prime Rating	
Alternator	Voltage	Ph	Hz	kW/kVA	Amps	kW/kVA	Amps
10M1003	277/480	3	60	2500/3125	3759	2250/2813	3383
10M1004	277/480	3	60	2500/3125	3759	2270/2838	3413
	220/380	3	50	2240/2800	4254	2000/2500	3798
10M1005	220/380	3	50	2240/2800	4254	2000/2500	3798
10M1014	347/600	3	60	2500/3125	3007	2270/2838	2730
10M1016	347/600	3	60	2500/3125	3007	2250/2813	2706
10M1204	1905/3300	3	50	2240/2800	490	2000/2500	437
10M1210	2400/4160	3	60	2500/3125	434	2250/2813	390
10M1211	2400/4160	3	60	2500/3125	434	2270/2838	394
	1905/3300	3	50	2240/2800	490	2000/2500	437
10M1316	3810/6600	3	50	2240/2800	245	2000/2500	219
10M1324	3810/6600	3	50	2240/2800	245	2000/2500	219
10M1414	7200/12470	3	60	2500/3125	145	2250/2813	130
	7620/13200	3	60	2500/3125	137	2250/2813	123
	7970/13800	3	60	2500/3125	131	2250/2813	118
10M1428	7200/12470	3	60	2500/3125	145	2270/2838	131
	7620/13200	3	60	2500/3125	137	2270/2838	124
	7970/13800	3	60	2500/3125	131	2270/2838	119
10M1447	6350/11000	3	50	2240/2800	147	2000/2500	131
10M1452	6350/11000	3	50	2240/2800	147	2000/2500	131

RATINGS: All three-phase units are rated at 0.8 power factor. *Standby Ratings:* Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. *Prime Power Ratings:* Prime power ratings apply to installations where utility power is unavailable or unreliable. At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528/1, overload power in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. For limited running time and base load ratings, consult the factory. Obtain the technical information bulletin (TIB-101) on ratings guidelines for the complete ratings definitions. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. GENERAL GUIDELINES FOR DERATION: *ALTITUDE:* Derate 1% per 100 m (328 ft.) elevation above 400 m (1312 ft.). *TEMPERATURE:* Derate 2.0% per 5°C (9°F) temperature above 40°C (104°F).

Alternator Specifications

Specifications	Generator
Type	4-Pole, Rotating-Field
Exciter type	Brushless, Permanent-Magnet
Voltage regulator	Solid State, Volts/Hz
Insulation:	NEMA MG1
Material	Class H (380–4160 V), Class F (6600 V) Synthetic, Nonhygroscopic
Temperature rise	130°C Standby
Bearing: quantity, type	2, Sealed
Coupling	Flexible Coupling
Amortisseur windings	Full
Rotor balancing	125% 60 Hz, 150% 50 Hz
Voltage regulation, no-load to full-load (with <0.5% drift due to temp. variation)	3-Phase Sensing, ±0.25%
One-step load acceptance at 60 Hz	100% of Rating
Unbalanced load capability	100% of Rated Standby Current
Peak motor starting kVA:	(35% dip for voltages below)
480V 10M1003 (4 bus bar)	5656 (60 Hz), — (50 Hz)
480V, 380V 10M1004 (4 bus bar)	6269 (60 Hz), 4799 (50 Hz)
380V 10M1005 (4 bus bar)	— (60 Hz), 5931 (50 Hz)
600V 10M1014 (4 bus bar)	7112 (60 Hz), — (50 Hz)
600V 10M1016 (4 bus bar)	6300 (60 Hz), — (50 Hz)
3300V 10M1204 (6 lead)	— (60 Hz), 5247 (50 Hz)
4160V 10M1210 (6 lead)	5122 (60 Hz), — (50 Hz)
4160V, 3300V 10M1211 (6 lead)	6402 (60 Hz), 3935 (50 Hz)
6600V 10M1316 (6 lead w/4 bus bar)	— (60 Hz), 5412 (50 Hz)
6600V 10M1324 (6 lead w/4 bus bar)	— (60 Hz), 5141 (50 Hz)
12470V 10M1414 (6 lead w/4 bus bar)	5394 (60 Hz), — (50 Hz)
13200V 10M1414 (6 lead w/4 bus bar)	5822 (60 Hz), — (50 Hz)
13800V 10M1414 (6 lead w/4 bus bar)	6178 (60 Hz), — (50 Hz)
12470V 10M1428 (6 lead w/4 bus bar)	5737 (60 Hz), — (50 Hz)
13200V 10M1428 (6 lead w/4 bus bar)	6206 (60 Hz), — (50 Hz)
13800V 10M1428 (6 lead w/4 bus bar)	6591 (60 Hz), — (50 Hz)
11000V 10M1447 (6 lead w/4 bus bar)	— (60 Hz), 5412 (50 Hz)
11000V 10M1452 (6 lead w/4 bus bar)	— (60 Hz), 5104 (50 Hz)

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Superior voltage waveform from two-thirds pitch windings and skewed stator.
- Digital solid-state, volts-per-hertz voltage regulator with ±0.25% no-load to full-load regulation.
- Brushless alternator with brushless pilot exciter for excellent load response.

Application Data

Engine

Engine Specifications	60 Hz	50 Hz
Manufacturer	Detroit Diesel/MTU	
Engine: model	20V4000 (T203-7M36)	20V4000 (T203-7M35)
Engine: type	4-Cycle, Turbocharged, Intercooled	
Cylinder arrangement	20V	
Displacement, L (cu. in.)	89.81 (5480)	
Bore and stroke, mm (in.)	165 (6.5) x 210 (8.3)	
Compression ratio	15.5:1	
Piston speed, m/min. (ft./min.)	756 (2480)	630 (2067)
Rated rpm	1800	1500
Max. power at rated rpm, kWm (BHP)	2740 (3675)	2420 (3245)
Cylinder head material	Cast Iron	
Crankshaft material	Forged Steel	
Valve (exhaust) material	High Alloy Steel	
Governor: type, make/model	MDEC Electronic Control	
Frequency regulation, no-load to full-load	Isochronous	
Frequency regulation, steady state	±0.25%	
Frequency	Fixed	
Air cleaner type, all models	Dry	

Exhaust

Exhaust System	60 Hz	50 Hz
Exhaust manifold type	Dry	
Exhaust flow at rated kW, m^3/min. (cfm)	558 (19705)	456 (16103)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	470 (878)	495 (923)
Maximum allowable back pressure, kPa (in. Hg)	5.1 (1.5)	
Exhaust outlet size at engine hookup, mm (in.)	2 @ 270 (10.63)	

Engine Electrical

Engine Electrical System	60 Hz	50 Hz
Battery charging alternator:		
Ground (negative/positive)	Negative	
Volts (DC)	24	
Ampere rating	70	
Starter motor rated voltage (DC)	Dual, 24	
Battery, recommended cold cranking amps (CCA):		
Quantity, CCA rating each	Four, 1150	
Battery voltage (DC)	12	

Application Data

Fuel

Fuel System	60 Hz	50 Hz
Fuel supply line, min. ID, mm (in.)	20 (0.79)	
Fuel return line, min. ID, mm (in.)	20 (0.79)	
Max. fuel flow, Lph (gph)	1800 (475)	1440 (380)
Min./max. fuel pressure at engine supply connection, kPa (in. Hg)	-10/150 (-3/44)	
Fuel filter	2, Secondary	
Recommended fuel	#2 Diesel	

Lubrication

Lubricating System	60 Hz	50 Hz
Type	Full Pressure	
Oil pan capacity, dipstick mark max., L (qt.)	340 (359)	
Engine oil capacity, initial filling, L (qt.)	390 (412)	
Oil filter: quantity, type	4, Spin-On	
Oil cooler	Water-Cooled	

Cooling

Radiator System	60 Hz	50 Hz
Ambient temp., standby rating, °C (°F)	40 (104)	45 (113)
Ambient temp., prime rating, °C (°F)	45 (113)	50 (122)
Engine water capacity, L (gal.)	260 (69)	
Radiator system capacity, including engine, L (gal.)	757 (200)	
Engine jacket water flow, Lpm (gpm)	1665 (440)	1383 (365)
Charge cooler water flow, Lpm (gpm)	632 (167)	500 (132)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	1100 (62555)	930 (52888)
Heat rejected to charge cooling water at rated kW, dry exhaust, kW (Btu/min.)	650 (36964)	440 (25022)
Water pump type	Centrifugal	
Fan diameter, including blades, mm (in.)	2362 (93)	
Fan, kWm (HP)	98 (131)	86 (115)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H_2O)	0.125 (0.5)	

Remote Radiator System*	60 Hz	50 Hz
Connection sizes:	Class 150 ANSI Flange	
Water inlet, mm (in.)	191 (7.5) Bolt Circle	
Water outlet, mm (in.)	191 (7.5) Bolt Circle	
Intercooler inlet/outlet, mm (in.)	152 (6.0) Bolt Circle	
Static head allowable above engine, kPa (ft. H_2O)	149 (50)	

* Contact your local distributor for cooling system options and specifications based on your specific requirements.

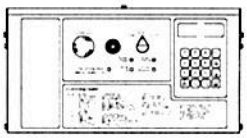
Operation Requirements

Air Requirements	60 Hz	50 Hz
Radiator-cooled cooling air, m^3/min. (scfm)÷	3539 (125000)	3047 (107600)
Cooling air required for generator set when equipped with CWC or remote radiator, based on 14°C (25°F) rise, m^3/min. (scfm)÷	759 (26800)	
Combustion air, m^3/min. (cfm)	228 (8052)	180 (6356)
Heat rejected to ambient air:		
Engine, kW (Btu/min.)	105 (5971)	
Generator, kW (Btu/min.)	107 (6084)	

÷ Air density = 1.20 kg/m^3 (0.075 lbm/ft^3).

Fuel Consumption	60 Hz	50 Hz
Diesel, Lph (gph) at % load	**Standby Rating**	
100%	647.3 (171.0)	551.4 (145.7)
75%	504.9 (133.4)	417.9 (110.4)
50%	352.8 (93.2)	287.1 (75.9)
25%	196.5 (51.9)	155.7 (41.1)
Diesel, Lph (gph) at % load	**Prime Rating**	
100%	593.9 (156.9)	498.7 (131.7)
75%	461.1 (121.8)	381.8 (100.9)
50%	327.8 (86.6)	263.6 (69.7)
25%	180.2 (47.6)	143.5 (37.9)

Controller



Decision-Maker™ 550 Controller
Audiovisual annunciation with NFPA 110 Level 1 capability.
Programmable microprocessor logic and digital display features.
Alternator safeguard circuit protection.
24-volt engine electrical system capability.
Remote start, remote annunciation, and remote communication options.
Refer to G6-46 for additional controller features and accessories.

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-565-3381, Fax 920-459-1646
For the nearest sales and service outlet in the
US and Canada, phone 1-800-544-2444
KohlerPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

Additional Standard Features

- Alternator Protection
- Alternator Strip Heater (standard on 3300 volt and above)
- Oil Drain Extension
- Operation and Installation Literature
- Pilot-Excited, Permanent-Magnet Generator
- Flexible Exhaust Connector, Stainless Steel

Available Accessories

Open Unit

- ❑ Exhaust Silencer, Critical Kit: GM30322-KP1
- ❑ Exhaust Silencer, Hospital Kit: GM30321-KP1

Cooling System

- ❑ Block Heater
  (recommended for ambient temperatures below 10°C [50°F])
- ❑ City Water Cooling
- ❑ Remote Radiator Cooling

Fuel System

- ❑ Flexible Fuel Lines
- ❑ Fuel Pressure Gauge
- ❑ Fuel/Water Separator
- ❑ Subbase Fuel Tank with Day Tank

Electrical System

- ❑ Battery
- ❑ Battery Charger, Equalize/Float Type
- ❑ Battery Charger, Equalize/Float Type Installed
- ❑ Battery Heater
- ❑ Battery Rack and Cables

Engine and Generator

- ❑ Air Cleaner Restriction Indicator
- ❑ Alternator Strip Heater (available up to 600 volt)
- ❑ Engine Fluids (oil and coolant) Added
- ❑ Winding RTDs (standard on 4160-6600V)
- ❑ Line Circuit Breaker (NEMA type 1 enclosure)
- ❑ Line Circuit Breaker with Shunt Trip (NEMA type 1 enclosure)
- ❑ Optional Generators
- ❑ Rated Power Factor Testing
- ❑ Spring Isolators (50/60 Hz)

Paralleling System

- ❑ Voltage Adjust Control

Maintenance and Literature

- ❑ General Maintenance Literature Kit
- ❑ Maintenance Kit
- ❑ NFPA 110 Literature
- ❑ Overhaul Literature Kit
- ❑ Production Literature Kit

Controller

- ❑ Common Failure Relay Kit
- ❑ Communication Products and PC Software
- ❑ Customer Connection Kit
- ❑ Dry Contact Kit (isolated alarm)
- ❑ Prime Power Switch
- ❑ Remote Annunciator Panel
- ❑ Remote Audiovisual Alarm Panel
- ❑ Remote Emergency Stop Kit
- ❑ Remote Mounting Cable
- ❑ Run Relay Kit

Miscellaneous Accessories

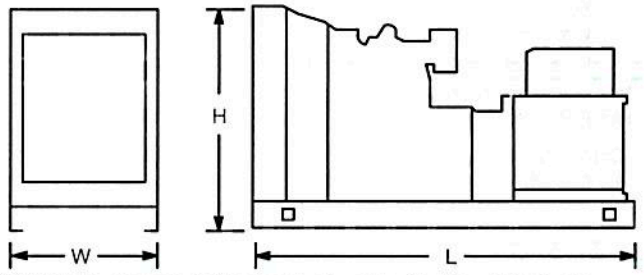
- ❑ _____
- ❑ _____
- ❑ _____
- ❑ _____
- ❑ _____

Dimensions and Weights

Overall Size, L x W x H, max., mm (in.): 7601-8020 x 2765 x 3107 (299.3-315.7 x 108.9 x 122.3)

Weight (radiator model), wet, max., kg (lb.): 26308 (58000)

Note: See ADV drawing for specific dimensions and weight based on generator selection.

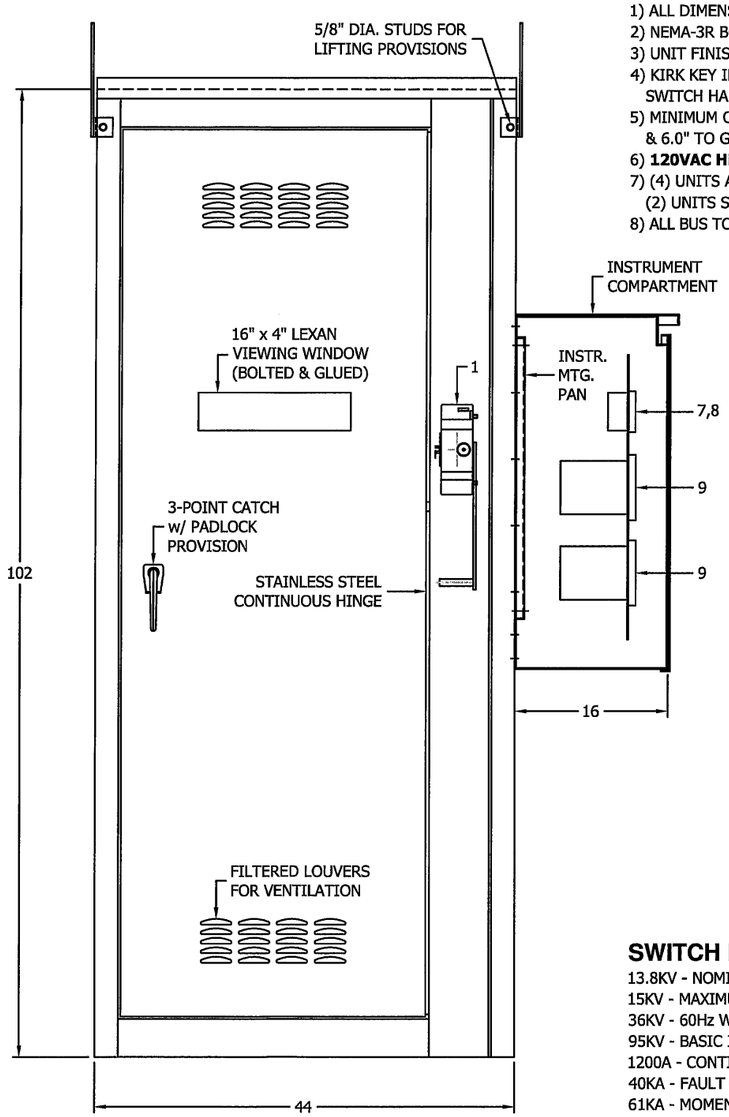


NOTE: This drawing is provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

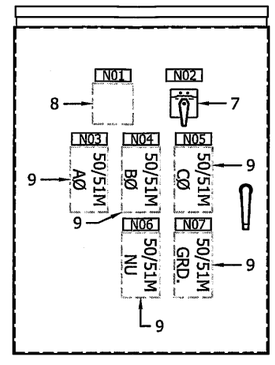
DISTRIBUTED BY:

NOTES:

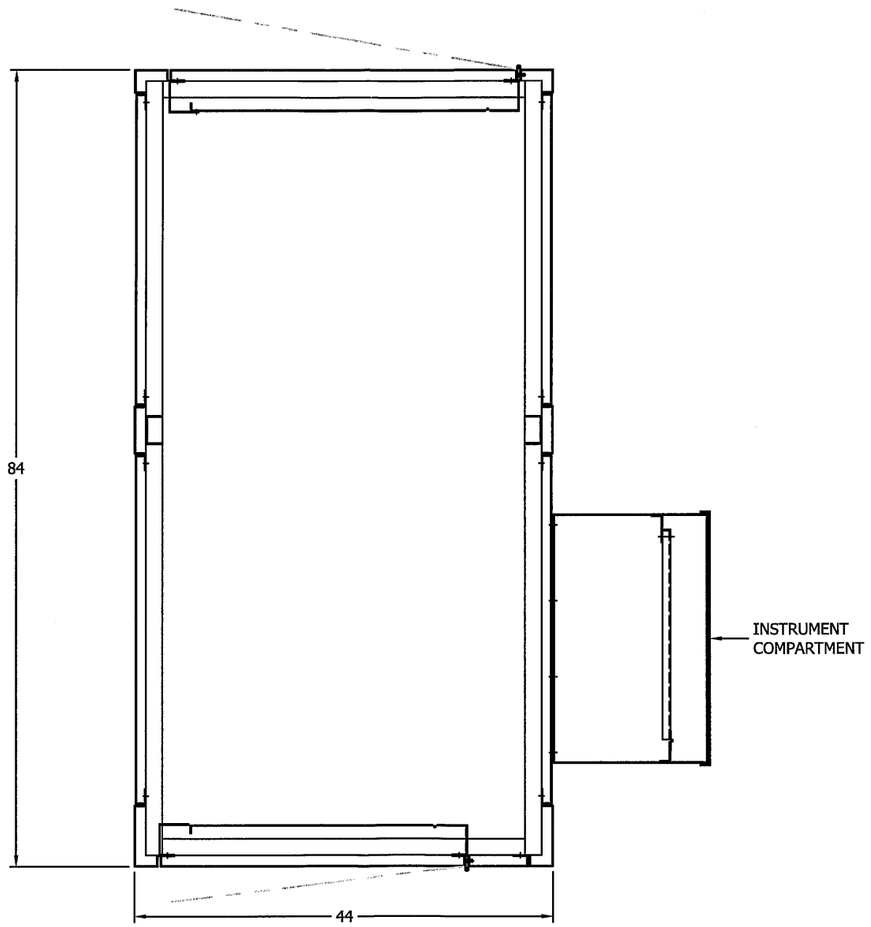
1) ALL DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED.
2) NEMA-3R BOLTED CONSTRUCTION OF #10 & #12 GA. SHEET STEEL.
3) UNIT FINISH: MUNSELL GREEN.
4) KIRK KEY INTERLOCKS ARE NOT PROVIDED, PER CUSTOMERS REQUEST.
   SWITCH HANDLE CAN BE PADLOCKED IN THE OPEN OR CLOSED POSITION.
5) MINIMUM CLEARANCE - 6.0" BETWEEN LIVE PARTS (PHASE TO PHASE)
   & 6.0" TO GROUND OR NON-CURRENT CARRYING PARTS.
6) **120VAC HEATER SOURCE BY OTHERS**.
7) (4) UNITS ARE REQUIRED ON THIS SALES ORDER. (2) UNITS SET UP FOR 15KV,
   (2) UNITS SET UP FOR 5KV (LABELED FOR 15KV SERVICE).
8) ALL BUS TO BE INSULATED.



FRONT VIEW



INSTRUMENT COMPARTMENT



PLAN VIEW

SWITCH RATING:

13.8KV - NOMINAL
15KV - MAXIMUM
36KV - 60Hz WITHSTAND
95KV - BASIC IMPULSE LEVEL
1200A - CONTINUOUS LOAD
40KA - FAULT CLOSE
61KA - MOMENTARY

BREAKER RATING:

15KV - MAXIMUM
95KV - BASIC IMPULSE LEVEL
1200A - CONTINUOUS LOAD
31.5KA - INTERRUPTING CURRENT

REV.	DATE	BY	CHANGES MADE
6			
5			
4			
3			
2			
1	08-07-13	PRS	REVISED NOTE 7

Penn Panel & Box Company
A Better Power Connection®
Phone: 610-586-2700 Fax: 610-522-0390
P.O. Box 1458, Willows Ave. Collingdale, PA 19023-8458
www.pennpanel.com E-mail: info@pennpanel.com
Custom Designed Electric Power Equipment Since 1938

SOLD TO:
PHILIPS BROTHERS
ELECTRICAL CONTRACTORS, INC.
235 SWEET SPRING ROAD
GLENMOOR, PA 19343

PROJECT/END-USER:
(STOCK)

SCALE: N.T.S.
DATE: 06-19-13
DRAWN BY: PRS
STD. DWG.:

CUST. P.O.: 35100
SHOP No.: 130216-01
DWG. No.: 14594-FV1
REV.: 01

JOB DESCRIPTION:
(4) NEMA-3R 15KV 1200A METAL ENCLOSED UNFUSED SWITCH & FIXED MOUNT BREAKER
(2) SET UP FOR 5KV OPERATION

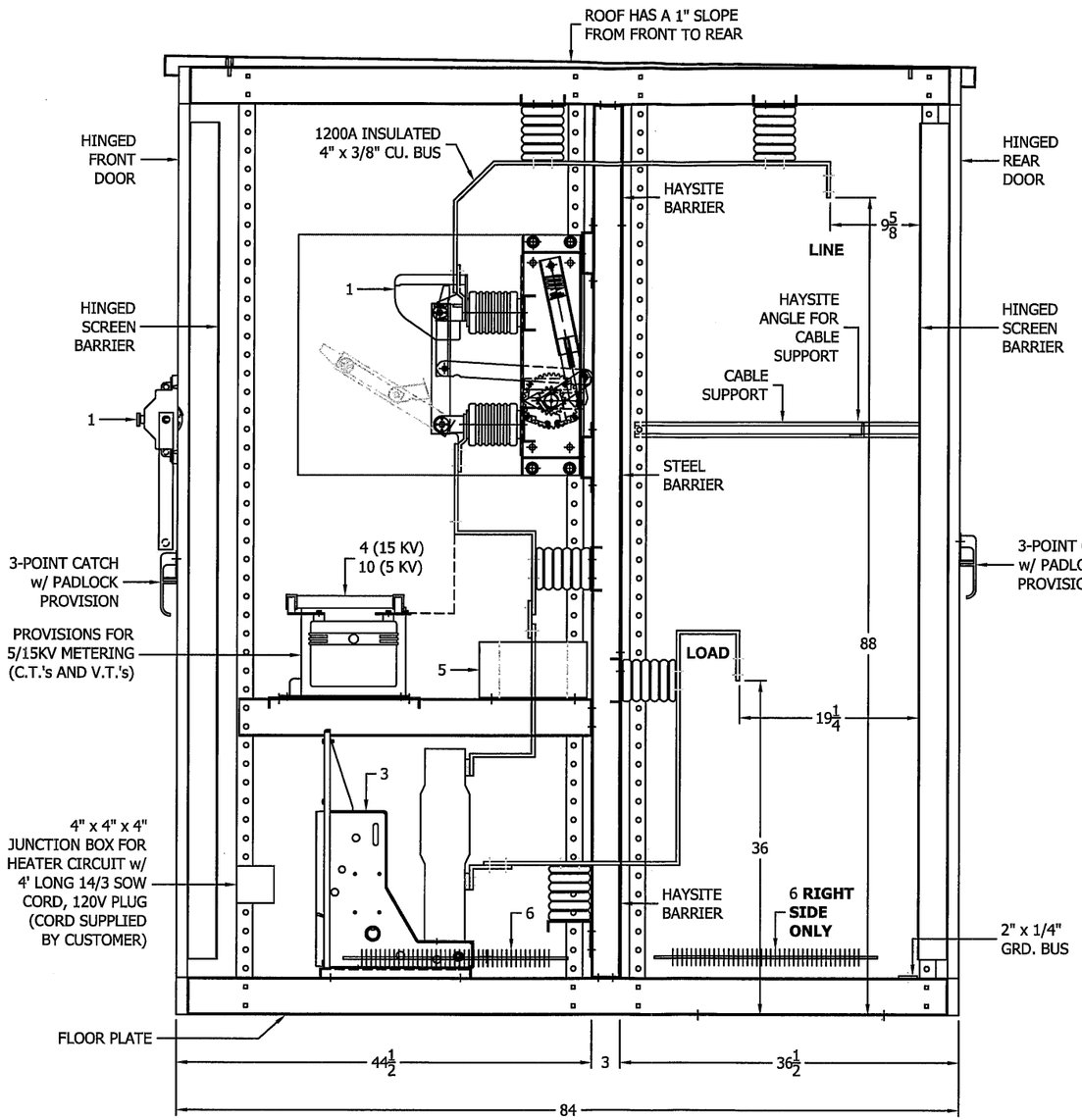
#	NAMEPLATE DATA			#
N01 BLACK/WHITE	○ MULTI METER ○ (4) RQD.		○ BREAKER CONTROL SWITCH ○ (4) RQD.	N02 BLACK/WHITE
N03 BLACK/WHITE	50/51M A PHASE ○ OVERCURRENT RELAY ○ (4) RQD.		50/51M B PHASE ○ OVERCURRENT RELAY ○ (4) RQD.	N04 BLACK/WHITE
N05 BLACK/WHITE	50/51M C PHASE ○ OVERCURRENT RELAY ○ (4) RQD.		50/51M NEUTRAL ○ OVERCURRENT RELAY ○ (4) RQD.	N06 BLACK/WHITE
N07 BLACK/WHITE	50/51M GROUND ○ OVERCURRENT RELAY ○ (4) RQD.		○ ○	N08

****COLOR LEGEND****

EXAMPLE

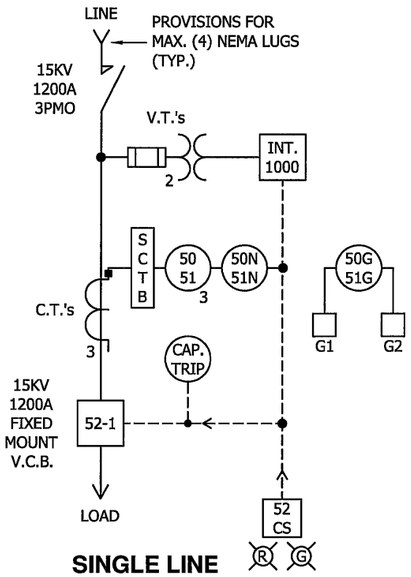
COLOR OF FACE → N00 BLACK/WHITE ← COLOR OF LETTERING

ALL NAMEPLATES 1" x 3" PHENOLIC SCREW-ON w/ 2 1/2" HOLE CENTERS UNLESS OTHERWISE NOTED.

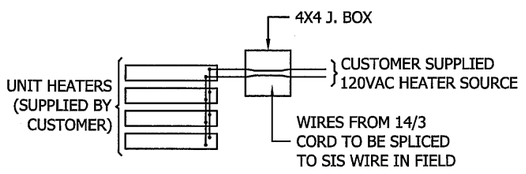


RIGHT SIDE SECTION VIEW

BILL OF MATERIAL (PER UNIT)			
NO.	MFG.	QTY.	DESCRIPTION
1	POWER-CON	1	15KV 1200A 3P MANUALLY OPERATED SWITCH w/ FRONT OPERATING HANDLE & INSULATING BARRIER KIT CAT. #541-029-A1-B1
2			
3	ABB	1	ADVAC 15KV 1200A 750MVA FIXED MOUNT BREAKER CAT. #AF3H111100000U0
4	G.E.	2	VOLTAGE TRANSFORMERS, 14,400-120V CAT. #765X021030 (15KV SETUP)
5	ITI	3	CURRENT TRANSFORMERS, 1200:5A CAT. #781-122MR
6	-	3	HEATERS (SUPPLIED BY CUSTOMER)
7	ELECTRO SWITCH	1	BREAKER CONTROL SWITCH w/ GREEN & RED L.E.D. LIGHTS
8	CROMP-TON	1	INTEGRA 1000 MULTIMETER (SUPPLIED BY CUSTOMER)
9	BASSLER	5	BE1-50/51M RELAYS (SUPPLIED BY CUSTOMER)
10	G.E.	2	VOLTAGE TRANSFORMERS, 4,200-120V 35:1 RATIO, DUAL FUSED CAT. #763X021018 (5KV SETUP)



SINGLE LINE



HEATER DETAIL

REV.	DATE	BY	CHANGES MADE
4			
4			
4			
3			
2			
1	08-07-13	PRS	REVISED ITEM 4 DESCRIPTION, ADDED ITEM 10, QTY. OF ITEM 6 TO 3

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SOLD TO: PHILIPS BROTHERS ELECTRICAL CONTRACTORS, INC. 235 SWEET SPRING ROAD GLENMOOR, PA 19343

PROJECT/END-USER: (STOCK)

SCALE: N.T.S.

DATE: 06-19-13 DRAWN BY: PRS

STD. DWG.:

CUST. P.O.: 35100

SHOP No.: 130216-01

DWG. No.: 14594-SV1 REV.: 01

JOB DESCRIPTION: (4) NEMA-3R 15KV 1200A METAL ENCLOSED UNFUSED SWITCH & FIXED MOUNT BREAKER (2) SET UP FOR 5KV OPERATION

Attachment E: Salisbury Substation – Equipment Layout and Description

INDIAN MOUNTAIN ROAD

MUDGE POND ROAD

LL018-003

LL018-001

LL018-002

LL018-009

LL018-008

Salisbury

Sharon

PROPOSED STANDBY GENERATOR UNITS

Salisbury Substation

1053

1052.5

S14

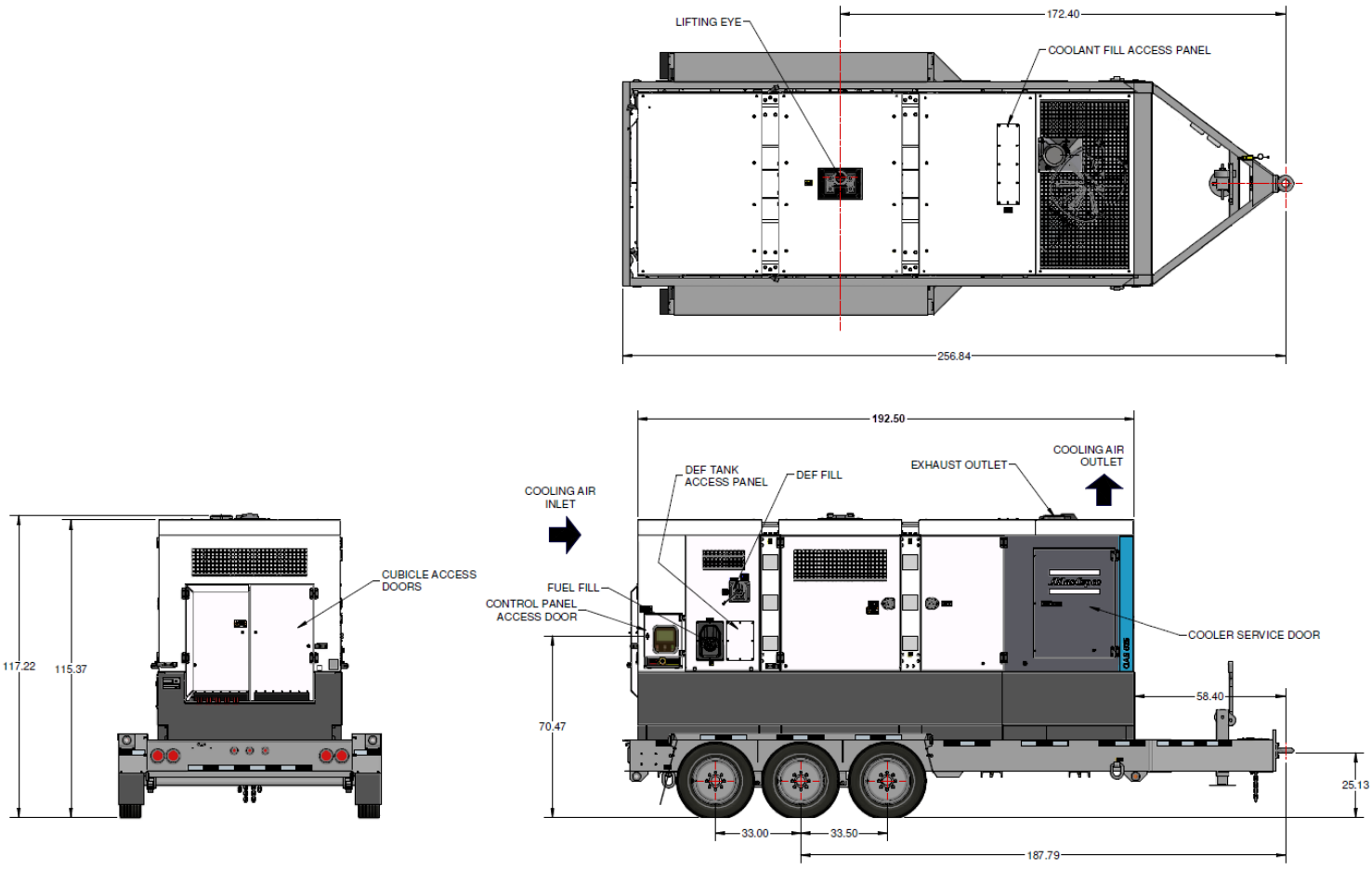
W11

0.5 MW Generator Unit
1 MW Generator Unit
15 KV Breaker Switch Combo
2500 KVA Transformer


0.5 MW GENERATOR UNITS
2500 KVA TRANSFORMER
1 MW GENERATOR UNITS
2500 KVA TRANSFORMER
2500 KVA TRANSFORMER
15 KV BREAKER SWITCH COMBO
Salisbury
Substation
2500 KVA TRANSFORMERS

Dimensions

Trailer Mounted



Weight - Wet (ready to operate)	Units	QAS625 VD
Trailer Mounted	lbs (kg)	25,679 (11,648)
Skid Mounted	lbs (kg)	22,119 (10,033)
Dimensions		
Trailer Mounted (L x W x H)	Inches	260 x 102 x 118
Skid Mounted (L x W x H)	Inches	194 x 70 x 110 *

*TBD

Main Data

Alternator

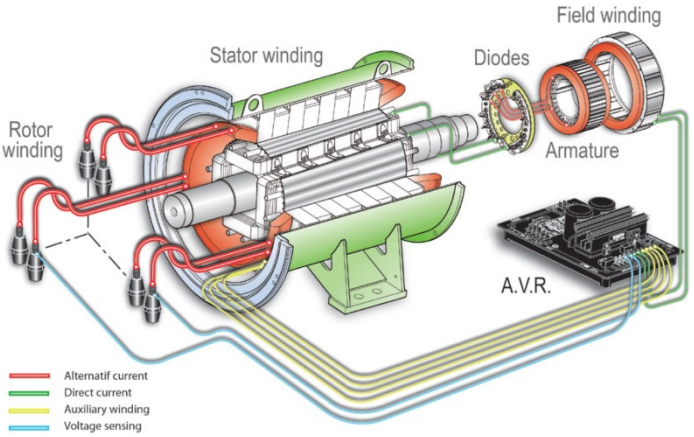
The Leroy Somer LSA alternators are designed for heavy duty continuous applications, with marine winding protection and Leroy Somer's AREP excitation system.

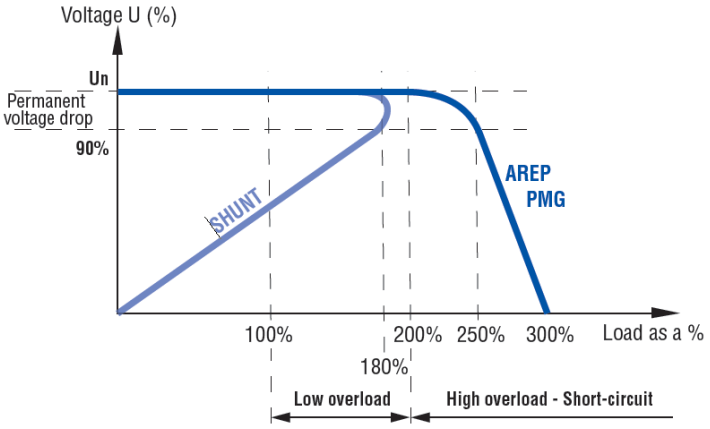
- AREP Excitation for superior motor starting capabilities
- Marine grade (relative humidity >95%) protection
- External multi-voltage selector switch (3 – position)
- 4 pole brushless design with single bearing, Class H insulation and IP23 rating
- Voltage regulation +/- 0.5%
- Full Load acceptance of prime power rating

The AREP system uses 2 independent auxiliary windings located in the main stator to send supply voltage to the AVR:

- The voltage delivered by the first auxiliary winding H1 is proportional to the alternator output voltage (shunt characteristic).
- The voltage delivered by the second auxiliary winding H3 is proportional to the current drawn by the alternator and is a function of the applied load (compound characteristic – booster effect).
- The resulting phase-to-phase voltage supplies power to the AVR.

This power supply to the AVR power circuit is independent of the voltage sensing measured on the alternator output terminals. Therefore, the excitation current delivered by the AVR to the alternator exciter is independent of any voltage distortions (harmonics) due to the load.
The AREP system gives the alternator a high overload capacity (load impact or starting electric motors) and a short-circuit capability (300% - 10 s) in order to provide discriminating protection: the alternator with AREP excitation is shorter than the one with PMG excitation. It is particularly suitable for demanding applications.





Performance @ Altitude and High Ambient Conditions

When using at altitude and high ambient conditions the engine and alternator will de-rate as per chart below.

		Temperature °C (°F)										
		0 (32)	5 (41)	10 (50)	15 (59)	20 (68)	25 (77)	30 (86)	35 (95)	40 (104)	45 (113)	50 (122)
Height m (ft)	0	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	500 (1640)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	1000 (3280)	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%
	1500 (4921)	99%	99%	99%	99%	99%	99%	99%	99%	99%	98%	96%
	2000 (6561)	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
	2500 (8202)	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%
	3000 (9842)	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
	3500 (11482)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%
	4000 (13123)	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
	4500 (14764)	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%
	5000 (16404)	77%	77%	77%	77%	77%	77%	77%	77%	77%	77%	77%

Power Distribution

The main power is connected from the alternator through a 3-position voltage selector switch to the main power cubicle. The cubicle incorporates all power distribution, controls, sensing and protection devices.

- ✓ 3-position Voltage Selector Switch (VSS)
- ✓ Current transformer x 3 (1 each leg)
- ✓ Single main breaker w/shunt trip
- ✓ Individual breakers for each receptacle
- ✓ Convenience receptacles located on outside of unit for easy access
- ✓ Terminal board for hard wiring
- ✓ Cam-Lock external quick connect
- ✓ External emergency stop switch (recessed)
- ✓ Neutral bonded to Ground with a removable bonding link accessible in the control cubicle

Please refer to the chart below for power distribution and voltages. NOTE: All voltages below are subject to change, depending on set point of "Fine Voltage Adjustment" potentiometer* and Voltage Selector Switch.

Fine Voltage Adjustment *	Voltage Selector Switch Position	120V Receptacle NEMA 5-20R	125/250V Receptacle CS6364	Terminal Board
	240V 1 PH	120V	240/120V	L1 L2 L3 N 240 120 120
	208/240V 3 PH	139V	240/139V	240 240 240 139 139 139
	208/240V 3 PH	120V	208/120V	208 208 208 120 120 120
	480V 3 PH	139V	240/139V	480 480 480 277 277 277

- All voltages are adjustable with the "Fine Voltage Adjustment" potentiometer located on the control panel. Therefore, voltage may be different then what is shown in the above table. All voltages should be verified before connection to the unit.

* Fine voltage adjustment with optional paralleling w/TDU via controller parameters

Convenience Receptacles

Receptacle	Type
X2, X3	120V - NEMA 5-20R
X4, X5, X6	125/250V - CS6364
X7	120V - NEMA 5-15P

Controller - Standard

The QAS 625 comes equipped with a DeepSea 7310 control module. This is a fully diagnostic ECU controller with large 3" display, that is intuitive and easy to operate with all functions conveniently at your fingertips. The controller also manages the engine ECU operating system, and several safety warnings and shut downs on various parameters (listed below).

The controller is powered by a main On/Off switch located next to unit.

DeepSea 7310 Controller Functionality:

Home Page (displayed while running, scrolling every 3seconds)
- ✓ Generator voltage (ph-ph)

Status Page
- ✓ Generator voltage (ph-N)
- ✓ Generator voltage (ph-ph)
- ✓ Generator frequency
- ✓ Generator kw
- ✓ Generator power factor
- ✓ Generator amperage

Generator Page
- ✓ Generator current (A)
- ✓ Generator earth current
- ✓ Generator load (kw)
- ✓ Generator load (kVA)
- ✓ Generator power factor
- ✓ Generator load (kVAr)
- ✓ Generator load (kWh, kVAh, kVArh)
- ✓ Generator phase sequence
- ✓ Dual mutual status

Event Page
- ✓ Displays the last 15 events

Remote Start/Stop
- ✓ Automatic start/stop via 2 wire dry contact connection

Operational Buttons
- ✓ Start button
- • Stop button
- • Automatic mode (external remote start)
- • Up/Down arrows

Info Page
- ✓ Model number
- ✓ USB identification number
- ✓ Configured engine type
- ✓ Module's date and time
- ✓ Scheduler setting

Engine Page
- ✓ Engine speed
- ✓ Oil pressure
- ✓ Coolant temperature
- ✓ Engine battery volts
- ✓ Run Time
- ✓ Oil Temperature
- ✓ Fuel Temperature
- ✓ Turbo Pressure
- ✓ Fuel Pressure
- ✓ Fuel Consumption
- ✓ Fuel Used
- ✓ Fuel Level
- ✓ Auxiliary Sensors
- ✓ Engine Maintenance Due
- ✓ Engine ECU Link

Engine DTC Page
- ✓ This page contains any active Diagnostic Trouble Codes that the engine ECU is currently generating. These alarms are conditions detected by the engine ECU and displayed on the DSE controller.

Controller - Optional

As an option, The QAS 625 comes with the Qc 4003 controller with a capacitive touch screen. This is a fully diagnostic ECU controller with large 7" diagonal (800 x 480 pixel) touch screen display that is intuitive and easy to operate with all functions conveniently at your fingertips. The controller also manages the engine ECU operating system, and a number of safety warnings and shut downs on various parameters.

Additionally, our Power Management System (PMS) enables the optimization of fuel consumption and expands the generator lifetime. PMS manages the quantity of generators running in parallel with load demand, starting and stopping units in line with increases or decreases in load. This ensures the demand on each generator remains at a level which optimizes fuel consumption. This also eliminates the need for generators to run with low load levels, which can cause engine damage and shorten the life expectancy of the equipment.

Qc 4003 Controller Benefits:

Modular Plant Capacity

- ✓ The Qc 4003 controller allows up to 32 generators to be coupled in parallel to fit the power requirement of any application.

Remote communication capability

- ✓ The Qc 4003 supports serial communication protocols including Modbus (RS-485, USB, and TCP/IP) and Profibus allowing you to supervise and control your genset/plant remotely.

User friendly rental interface

- ✓ Rental companies will benefit from the standardized user interfaces. The controller has been designed with ease of operation in mind, and rental companies can easily set and lock parameters to ensure full protection of their equipment.

Available Modes:

- ✓ **Island mode -** Power plant with synchronizing generators or a stand-alone generator. Also applicable in critical power plants.
- ✓ **Automatic Mains Failure -** Critical power/emergency standby plants, black start generator.
- ✓ **Fixed power -** Power plant with fixed kW set point (including building load).
- ✓ **Peak shaving -** Power plant where generator supplies peak load demand paralleled to the mains.
- ✓ **Load takeover -** Plant mode where the load is moved from mains to generator, for example peak demand periods or periods with risk of power outages.
- ✓ **Mains power export -** Power plant with fixed kW set point (excluding building load).
- ✓ **Remote maintenance -** Used when the generator must supply the load while a distribution transformer is disconnected for service.

  * All modes are configurable, and it is possible to change the plant mode on the fly both in single and in power management applications.

Engine

Volvo

Volvo Tier 4 Final, turbo charged, intercooled, six-cylinder, liquid-cooled diesel engine provides ample power to operate the generator continuously at full-load.

Meets all US EPA, CARB and Environment Canada exhaust legislations with Tier 4 Final compliance. The engine utilizes a Selective Catalytic Reduction (SCR) and Diesel Exhaust Fluid (DEF) to meet final Tier 4 emissions. All functionality of the engine is monitored automatically on the controller.

The engine has the capability to start the generator at 14°F (-10°C) with standard glow-plug aid. Cold start options are available for machine starting for down to -13°F (-25°C).

The 707 Gal (2,646 l) fuel tank is sufficiently sized to operate the unit at full-load condition for long run times (see chart on page 2 for specifications).

The engine operates on a 24V negative ground electrical system with a charging alternator and lockable battery cutoff switch.

The cooling system is suitably designed for continuous operation in ambient conditions up to 122°F (50°C), with canopy door closed.

Fuel System

A large 707 US Gal (2,676 l) fuel tank provides safe diesel storage while eliminating tank corrosion contaminants from being introduced to your fuel system. With integrated fuel water separator and filter, the system is designed to help maintain clean and trouble-free diesel supply to the engine for reliable trouble-free operation.

- ✓ Pad-lockable diesel fill cap
- ✓ Fuel / Water separator
- ✓ Inline priming pump (w/ filter)
- ✓ Fuel pre-filter
- ✓ Fuel supply pump (w/ strainer)
- ✓ Fuel level sensor
- ✓ Low fuel shut down feature (programmable level)
- ✓ External fuel connections w/3-way valve and quick disconnects

Scheduled maintenance

Standard equipped with filters sized and designed to allow 500-hour service intervals under normal operating conditions. Extended time between services reduces down time and total cost of ownership of the unit over its lifetime.

500 Hour Service Interval:

- ✓ Oil filter
- ✓ Fuel filter
- ✓ Fuel / water separator

1000 Hour Service Interval:

- ✓ Air filter
- ✓ Oil filter
- ✓ Fuel filter
- ✓ Fuel / water separator

NOTE: Site specific operating conditions such as; poor fuel quality and low load profile may require more frequent service intervals.

Enclosure & Frame

The generator enclosure is designed for extreme applications to provide superior performance and reliability.

The enclosure is fabricated from coated steel which is powder coated for corrosion resistance. The enclosure and frame are fully sealed from the radiator to the back of the unit, providing a true 110% containment of all fluids.

- ✓ Zinc rich primer, powder coated enclosure
- ✓ Heavy duty base frame
- ✓ 110% fluid containment
- ✓ Superior level of rain ingress protection and design features
- ✓ Pad-lockable doors and fuel cap
- ✓ Engine fluid plumbed to exterior of frame for ease of service
- ✓ Central lifting point
- ✓ Sound dampening material and design to allow quiet operation at 73 dB(A)

Undercarriage

The QAS 625 is available with two undercarriage alternatives, providing utmost flexibility in installation, site handling or towing. Both the skid frame and the trailer mount the same way and can be interchanged for versatility.

- Trailer mounted:
  - ✓ Triple axle trailer
  - ✓ Electric brakes
  - ✓ DOT/Federal approved light package and 6 pin plug
  - ✓ Adjustable height pintle hitch (3" lunette)
  - ✓ 17.5" Rims with 215/75R LR H Tires for trailer use
  - ✓ Heavy Duty torsion axles
  - ✓ Safety chains
  - ✓ Screw jack leveling, with pad foot
  - ✓ Single point lifting structure
  - ✓ Tie down points x4

- Skid mounted:
  - ✓ Sub-frame skid with integrated forklift pockets
  - ✓ Heavy duty design for use in extreme conditions
  - ✓ Built-in locations for straps or chains to secure the unit for transport
  - ✓ Single point lifting structure

Factory Options Available

- Paralleling with TDU (touch display unit)
- Skid mounted
- Cold Weather Option
- Spare tire
- Stabilizer jacks
- Toolbox

Manufacturing & Environmental Standards

The **QAS 625 VD** are manufactured following stringent ISO 9001 regulations, and by a fully implemented Environmental Management System fulfilling ISO 14001 requirements.

Attention has been given to ensure minimum negative impact to the environment.

The **QAS625 VD T4F** meets all current US EPA, CARB and Environment Canada exhaust and noise emission directives.

Supplied Documentation

The unit is delivered with documentation regarding:

- Hard copies of the Atlas Copco Operators Safety and Instruction Manual, Atlas Copco Parts Book, Volvo Engine Manual and Parts book, in English as well as electronic copies available on request.
- Warranty Registration card for engine and Atlas Copco Generators (Units must be registered upon receipt).

Warranty Coverage

Atlas Copco Generator: Warrantied to be free from defects with regard to material and workmanship for the period of eighteen (18) months from date of shipment from the factory, or twelve (12) months from date of initial startup, whichever occurs first, without limitation of running hours.

Volvo Engine: Twenty four (24) months or a maximum of three thousand (3000) hours of operation whichever occurs first (with the first twelve (12) months at unlimited running hours).

Leroy Somer Alternator: Warrantied to be free from defects with regard to material and workmanship for the period of twenty-seven (27) months from date of shipment from the factory, or twenty-four (24) months from date of initial startup or 10,000 hours, whichever occurs first.

Specification sheet

Rental Power 1000 kW

Description

This Cummins Power Generation rental package is a fully integrated mobile power generation system, providing optimum performance, reliability, and versatility for standby and prime power applications.

The package utilizes custom designed switchgear to meet severe customer requirements. This switchgear provides reconnectable voltage via a link board design, automatic start/stop control and easy connection to existing installations.

Features

Cummins diesel engines

- Rugged 4-cycle industrial diesel delivers reliable power and fast response to load changes.
- Equipped with heavy duty air cleaners, bypass-type oil filters and dual-element fuel/water separator filtration system with 4-way valve.
- Includes jacket water heaters for more reliable operation in emergency standby applications.

Control system

- The most advanced, reliable, and capable generator set control system available in the market today.
- Integrated generator set providing precise frequency and voltage regulation, alarm and status message display in one easy-to-operate customer interface.
- Remote monitoring and operation ready.
- Auto shutdown at fault detection.

Stamford alternators

- Designed and built by Cummins Generator Technologies.
- Voltage - 480/208 VAC standard (600 VAC optional).
- Alternators designed for improved motor starting.
- Permanent magnet excitation for improved performance in cyclic and non-linear load applications.

Rental package enclosure

- Designed for serviceability access.
- Optimized fuel capacity.
- Fluid containment design for greater environmental protection.
- Sound attenuated to minimize impact on local environment.
- Vertical cooling air and engine exhaust path to minimize sound level adjacent to the container.
- Equipped with 24 VDC lighting.
- Unit has paralleling capabilities at 480 and 600 VAC only.
- Utility grade breaker.
- Shore power 100 amp service breaker panel – single phase 120/240 VAC: (2) 30 amp breakers (1 for each coolant heater) – 240 VAC (26.75 amp = 6420 watts for the heater). (1) 15 amp breaker – 120 VAC (GFIs), (1) 15 amp breaker – 120 VAC (battery charger).

Options

Cold weather package (includes):

- Additional diesel fired block heater
- Battery heating pad
- Floor insulation
- Actuated louver control
- Transport Canada UN31A certified fuel tank

Model	Voltages (V)	Standby Rating 60 Hz kW (kVA)	Standby Rating 50 Hz kW (kVA)	Prime Rating 60 Hz kW (kVA)	Prime Rating 50 Hz kW (kVA)	Engine model	Alternator model	Generator* Specification Sheet (Ref)
C1000D6RG	208/480	1000 (1250)		900 (1125)		QST30-G5	HCI634K	S-1508
	600	1000 (1250)		900 (1125)		QST30-G5	HCI634K	S-1508

* Not all reference data Is applicable.

Our energy working for you.™

cumminspower.com

Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	±0.5%
Random voltage variation	±0.5%
Frequency regulation	Isochronous
Random frequency variation	±0.25%
Radio frequency interference	IEC 801.2, through IEC 801.5, MIL STD 461C, Part 9

Engine specifications

Engine model	QST30-G5
Engine data sheet	DS-5247
EPA Nonroad	TPEM (Tier 2)
Design	4 cycle, V-block, turbocharged and low temperature after-cooled
Bore	140 mm (5.51 in.)
Stroke	165 mm (6.5 in.)
Displacement	30.5 liters (1860 in^3)
Cylinder block	Cast iron, 50° V 12 cylinder
Battery capacity	8D (qty: 4) 1250 CCA @ 0 °F and 1500 CCA @ 32 °F
Battery charging alternator	24 volt 35 amp Delco Remy
Starting voltage	24 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel
Fuel filter	Triple element, 10 micron filtration, spin on fuel filters with water separator. Additional Fleetguard Industrial Pro Pre-filters
Air cleaner type	2-stage dry replaceable element with dust ejectors (qty: 2)
Lube oil filter type(s)	Four spin-on combination full-flow and bypass filters
Oil capacity	154L (162.8 qt)
Standard cooling system	122 °F (50 °C)

Alternator specifications

Alternator data sheet	ADS-312
Design	Brushless, 4-pole, revolving field
Stator	Double layer lap 2/3 pitch
Rotor	Single bearing, flexible disc
Insulation system	Class H per NEMA MG1-1.65 (208/480 VAC), Class F per NEMA MG1-1.65 (600 VAC optional)
Standard temperature rise	125/40 °C standby (208/480 VAC), 105/40 °C standby (600 VAC optional)
Exciter type	PMG (Permanent Magnet Generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal fan
AC waveform total harmonic distortion	No load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Power capability specifications

	Standby rating			
	240 V, 1 phase Amps	**208 V, 3 phase Amps**	**480 V, 3 phase Amps**	**600 V, 3 phase Amps**
C1000D6RG		3296	1503	1204

Electrical power panel specifications

Model voltage	**120 V duplex receptacles**	**240 V twist**	**Load lug connection (stud diameter)**	**Load lug circuit breakers**
208/480 V	2 (20 amp)		1/2	3000 amp
600 V	2 (20 amp)		1/2	1600 amp

Site derating factors

Standby application: The engine may be operated at 1800 rpm up to 2000 ft (600 m) and 104 °F (40 °C) without power deration. For sustained operation above the conditions, derate by 3% per 1000 ft (300 m) and 13% per 18 °F (10 °C).

Control system

PowerCommand control with AmpSentry™ protection

- Integrated automatic voltage regulator and engine speed governor
- AmpSentry protection guards the electrical integrity of the alternator and power system from the effects of overcurrent, over/under voltage, under frequency and overload conditions
- Control components designed to withstand the vibration levels typical in generator sets

Standard control description

- Analog % of current meter (amps)
- Analog AC frequency meter
- Analog AC voltage meter
- Analog % of load meter (kW)
- Cycle cranking control
- Digital display panel
- Emergency stop switch
- Idle mode control
- Menu switch
- Panel backlighting
- Remote starting, 12 volt, 2 wire
- Reset switch
- Run-off-auto switch
- Sealed front panel, gasketed door
- Self diagnostics
- Voltmeter/ammeter phase selector switch

Standard performance data warnings

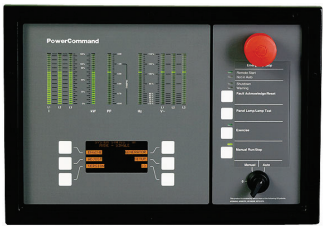
- High coolant temperature
- High DC voltage
- Low coolant temperature
- Low DC voltage
- Low oil pressure
- Over current
- Overload load shed contacts
- Up to four customer fault inputs
- Weak battery
- Overflow
- Overspeed
- Short circuit
- Underfrequency

Standard protection functions

- Voltmeter/ammeter phase selector
- Warnings
- High Coolant Temperature
- High DC Voltage
- Low Coolant Temperature
- Low DC Voltage
- Low Oil Pressure
- Over Current
- Overload Load Shed Contacts
- Up to Four Customer Fault Inputs
- Weak Battery
- Overflow

Shutdowns

- Emergency stop
- Fail to crank
- High AC voltage
- High coolant temperature
- Low coolant level
- Low AC voltage
- Low oil pressure
- Overcurrent
- Overspeed
- Short circuit
- Underfrequency
-



Optional Features Shown

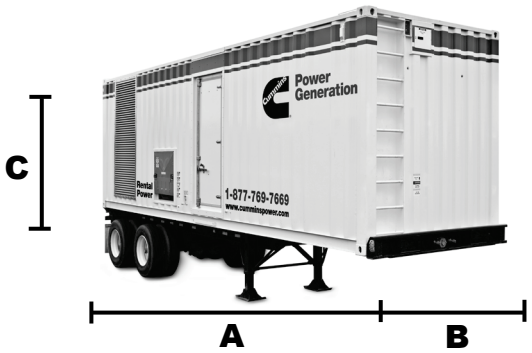
Ratings definitions

Standby:

Applicable for supplying emergency power for the duration of normal power interruption. No sustained overload capability is available for this rating. (Equivalent to Fuel Stop Power in accordance with ISO3046, AS2789, DIN6271 and BS5514). Nominally rated.

Prime (unlimited running time):

Applicable for supplying power in lieu of commercially purchased power. Prime power is the maximum power available at a variable load for an unlimited number of hours. A 10% overload capability is available for limited time. (Equivalent to Prime Power in accordance with ISO8528 and Overload Power in accordance with ISO3046, AS2789, DIN6271, and BS5514).



Dimensions

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Weight w/o fuel kg (lbs)	Weight with fuel kg (lbs)	Fuel capacity liters (gal)
C1000D6RG	**9119** (359)	**2438** (96)	**2896** (114)	**15594** (34600)	**21182** (46698)	**6450** (1704)
With chassis	**9119** (359)	**2438** (96)	**4064** (160)	**18724** (41280)	**24212** (53378)	**6450** (1704)

Note: Optional cold weather package adds 54 kg (120 lbs).
Optional Transport Canada fuel tank capacity 1300 gal.

Fuel consumption

		Standby				Prime			
60 Hz Ratings, kW (kVA)		**1000 (1250)**				**900 (1125)**			
	Load	¼	½	¾	Full	¼	½	¾	Full
	US Gal/hr	19.1	35.8	54.1	72.2	17.3	32.1	47.5	63.9
	L/hr	72.3	135.5	204.8	273.3	65.5	121.5	179.8	241.9

Specifications

Model	KW rating		Sound level at full load	Tier rating	Hours of operation (75% load)	
	Standby	**Prime**	**dB(A) @ 7 m**	**Standby**	**Standby**	**Prime**
C1000D6RG	1000	900	75 dBa	TPEM (Tier II)	31	35
					With Transport Canada fuel tank	
					24	27

Accessories

	Part Number
30 ft. Air Ride Chassis	0410-1379
Fueling Ladder	0410-1372
Access Ladder*	0410-1371
Folding Ladder	0410-1362

* One access ladder provided with purchase of unit

Codes and standards

Below certifications are for generator set only

This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.

The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.

All low voltage models are CSA certified to product class 4215-01.

The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies.

U.S. EPA

Engine previously certified to U.S. EPA Nonroad Source Emissions Standards, 40 CFR 89, Tier 2. The engine used in this generator set may be used in mobile applications in accordance with the EPA Transition Program for Equipment Manufacturers (TPEM); this provision has specific limitations (see 40 CFR, 1039.625).

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S-1554l (4/13)

Power Generation

cumminspower.com

Technical Data

February 2017

Cummins QST30 G5	CGT Stamford HCI 634 J	Generator Model:	G1000RA3CU

60 Hz	3-Phase	Power Factor Cos Φ = 0.8	Emissions EPA Tier 2 Flex Certified

60Hz RATINGS*	PRIME POWER (PRP)		STANDBY POWER (ESP)		
Voltage	kVA	kWe	kVA	**kWe**	Amps
208/120 (optional)	1081	865	1081	**865**	3000
480/277	1150	920	1269	**1015**	1526

*Ratings net of cooling fan auxilliary loads

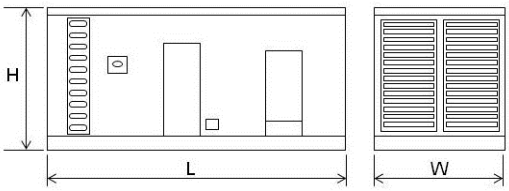
Definition of Ratings & Reference Conditions

Prime Power (PRP) is the nominal output continuously available, where the average load (variable) does not exceed 70% of the prime power rating. 10% overload is available for a maximum of 1 hour in 12 hours of operation.
Standby Power (ESP) is the maximum output available, for up to 500 hours per year, where the average load does not exceed 70% of the standby power rating. No overload is available.
Standard Reference Conditions: air inlet temperature 25°C (77°F), barometric pressure 100kPa, [110m (361ft) altitude], 30% relative humidity.
Note: The above ratings may be subject to derate at different operating conditions. Please see the Derate Guidelines on the JCB Power Products website.
All power ratings and reference conditions in accordance with ISO 8528-1 and ISO 3046-1.

For representation purposes only

Key Features:

- Water cooled Cummins diesel engine
- EPA - Tier 2 Flex - emissions certified engine
- Heavy duty rubber captive anti-vibration mountings
- Single bearing CGT Stamford alternator
- Electronic speed governor
- Fuel water separating filter - Racor
- Three way fuel valve - single lever operation
- 6400 litre / 1690.70 gallon UL fuel tank with secondary fluid containment
- Internal fill point & gauge within separate fuel compartment
- 30ft ISO standard container (CSC Plated)
- Engine compartment with full fluid containment
- Integral box type residential silencer
- Separate cooling compartment
- Variable speed electrical cooling fans
- Livelink telematics
- DSE auto-start controller
- 3 pole UL listed circuit breaker with bus-bar chamber
- Heavy duty sealed lead acid batteries 2 x 12V
- Battery isolator



Overall Dimensions & Weights

Length (L) = 9125mm / 359.25 (in)
Width (W) = 2438mm / 95 (in)
Height (H) = 2591mm / 102 (in)

Dry Weight (inc oil) = 20,182kg / 44493 (lb)
Operating Weight = 26,127kg / 57600 (lb)

Typical Free Field Sound Pressure Levels at 100% of Prime Power at standard reference conditions

	1m (39in)	5m (196in)	7m (275in)	10m (393in)
dBA	84	76	74	70

All specifications and design are subject to change without notice

G1000RA3CU

February 2017

ENGINE & COOLING SYSTEM — CUMMINS QST30 G5 - 60Hz

		SI Units	US Units	PRIME	STANDBY
Performance	Engine Speed	r/min	r/min	1800	
	Gross Power	kWm	(bhp)	1007 (1350)	1112 (1491)
	Fan Power (Mechanical)	kWm	(bhp)	N/A	N/A
	Net Power	kWm	(bhp)	1007 (1350)	1112 (1491)
	Emissions Certification			EPA Tier 2	
	Altitude Capability	m	(ft)	1600 (5249)	1600 (5249)
General	Cylinders / Type			12 cyl / 50° Vee / 4-stroke	
	Aspiration / Charge Cooling			Turbocharged / 2 Pump 2 Loop	
	Governing / Engine Management			Electronic Governor / ECU	
	Bore / Stroke	mm	(in)	140 (5.51) / 165 (6.49)	
	Cubic Capacity	litres	(cu.in.)	30.48 (1860)	
	BMEP	kPa	(psi)	2203 (319.5)	2432 (352.7)
Fuel	Fuel Consumption at 100% Power	litres/h	(gal/h)	248 (65.51)	275 (72.65)
	Fuel Consumption at 75% Power	litres/h	(gal/h)	185 (48.87)	205 (54.16)
	Fuel Consumption at 50% Power	litres/h	(gal/h)	126 (33.29)	140 (36.98)
	Total fuel flow	litres/h	(gal/h)	570 (150.6)	
	Standard Fuel Tank Capacity (useable)	litres	(gal)	6400 (1690.70)	
Air	Engine Air Flow	m³/s	(cfm)	1.46 (3094)	1.57 (3327)
	Maximum Air Intake Restriction (used filter)	kPa	(inWG)	6.23 (25.01)	
Exhaust	Exhaust Gas Flow	m³/s	(cfm)	3.285 (6961)	3.67 (7776)
	Exhaust Gas Temperature	°C	(°F)	495 (923)	525 (977)
	Maximum Exhaust Back Pressure	kPa	(inWG)	6.8 (27.3)	
	Typical Exhaust Pipe Diameter	mm	(in)	355 (13.97)	
Cooling	Radiator Cooling Air Flow	m³/s	(cfm)	32 (67880)	
	Max Restriction to Cooling Air Flow	Pa	(inWG)	N/A	
	Max Radiator Air-On Temperature	°C	(°F)	45 (113)	
	Maximum Coolant Temperature	°C	(°F)	104 (219)	
	Coolant Capacity - Engine Only	litres	(gal)	79 (20.86)	
	Total Coolant Capacity	litres	(gal)	145 (38.30) (HT) + 140 (36.98) (LT)	
Oil	Total Oil Capacity incl Filters	litres	(gal)	154 (40.6)	
	Typical Oil Pressure at Rated Speed	kPa	(psi)	345 (50.4)	
	Typical Oil Consumption (>250hrs Operation)	litres/h	(pt/h)	0.65 (1.14)	
Thermal	Heat Rejection to Engine Cooling Water	kW	(btu/min)	355 (20190)	380 (21610)
	Heat Rejection to Charge Cooler	kW	(btu/min)	325 (18480)	280 (15920)
	Heat Radiated From Engine (Typical)	kW	(btu/min)	125 (7109)	140 (7962)
Elec	Electrical System Voltage	V	V	24	
	Battery Type			2 x 624	
	Battery Capacity SAE CCA	A	A	1050	

ALTERNATOR — CGT STAMFORD HCI 634 J

		SI Units	US Units	PRIME	STANDBY
General Data	Manufacturer			Cummins Generator Technologies - STAMFORD	
	Model			HCI 634 J	HCI 634 J
	Operating Temperature	°C	(°F)	40 (104)	27 (81)
	Coupling / No. of Bearings			Direct / Single Bearing	
	12 Wire / Poles / Winding Type			12 Wire / 4-Pole / Winding 311	
	Power Factor			Cos Φ = 0.8	
	Excitation			PMG/Self Excited	
	Insulation System			Class H	
	AVR Type			MX 341	
	Voltage Regulation			± 1.0%	

G1000RA3CU

February 2017

STANDARD CONTROL SYSTEM — DSE 7310 Digital Auto Start

The standard control system for this model is DSE **7310** (photo), based on the Deep Sea Electronics DSE7310 Digital Auto Start controller.

This provides for the manual and automatic remote start of the generator, together with full CANBus implementation for the control and protection of the engine via the ECU. LCD digital display of :

- Coolant temperature with high temperature alarm and shutdown
- Oil pressure with low pressure alarm and shutdown
- Oil temperature, engine operating hours, battery charge volts and amps
- Volts, with Under/Over Volts protection
- Amps, with Over Current protection
- Frequency, kW, kVA, Power Factor
- Full RS485 Telemetry implementation
- Automatic cool-down timer function
- Ample auxiliary inputs/outputs for optional features

OPTIONAL CONTROL SYSTEM 1 — DSE 8610 Digital Synchronisation

DSE 8610 control systems provide the same features as DSE 7310, plus :

- Sequential set start
- Manual voltage/frequency adjustment
- R.O.C.O.F. and vector shift protection
- Generator load demand
- Automatic hours run balancing
- Mains (Utility) de-coupling
- Mains (Utility) de-coupling test mode
- Dead bus sensing
- Bus failure detection
- Direct governor and AVR control
- Volts and frequency matching
- kW and kV Ar load sharing
- Dead bus synchronising

OPTIONAL CONTROL SYSTEM 2 — DEIF AGC-4 Digital Synchronisation

Suitable for a wide range of applications, the AGC-4's standard sequences include back-up power, start/stop, synchronisation, and load sharing.

This provides for the manual and automatic remote start of the generator, together with full CANBus implementation for the control and protection of the engine via the ECU.

Featuring:

- Multiple operating modes in one software
- Synchronisation of up to 56 breakers in one plant
- Multi-master power management
- Load-dependent start and stop
- Load management
- Close Before Excitation – Synchronisation in less than 10 sec
- Optional Full RS485 Telemetry implementation
- Automatic cool-down timer function
- Ample auxiliary inputs/outputs for optional features
- Approvals include TÜV and UL.

G1000RA3CU

February 2017

KEY FEATURES - STANDARD

Engine :

- V12 four stroke turbocharged low temperature diesel engine
- Captive type, anti-vibration mountings
- Heavy duty base-frame
- Crankcase breather to atmosphere
- First fills of lube oil and coolant
- Suitable protection to exposed exhaust and turbo hot surfaces
- Lube oil drain valve with evacuation pump
- 100 litre lube oil auto make-up tank
- Vertical discharge exhaust with rain cap

Container :

- 30ft ISO Standard CSC plated container
- Engine compartment containment for >110% of engine fluids
- The complete set is acoustically lined to achieve noise reduction to 74dBA @ 7m (275 in) & 84dBA @1m (39 in)
- Double access doors to radiator compartment
- Side personnel & maintenance doors
- Low level steel door furniture
- Low level control module for trailer use
- Access ladder stowage within fuel tank compartment

Cooling :

- Aftercooled 2 pump / 2 loop
- Separate cooling compartment
- Electrically driven multiple cooling fans
- Low coolant level shutdown / alarm
- Coolant drain valve
- Easy coolant access

Circuit Breaker Box :

- With door giving access to a set rated, terminal box, housing a 3 pole motorised UL circuit breaker
- Bus-bar chamber housing terminals for ease of connection
- Earthling terminal stud / bus bar
- Neutral to earth connection point
- Input socket for supply to optional battery charger and jacket water heater
- Terminals for auto start signal cabling & load share

Alternator :

- IP23
- Class H insulation
- Voltage regulation to ±1%, at any power factor, 0.8 lagging - unity
- PMG

Electrical :

- DSE 7310 auto-start controller
- Livelink telematics (DSE only)
- External emergency stop button
- Interlock on cable entry panel
- Analogue hour meter
- Heavy duty batteries
- Battery Isolator

Fuel Systems :

- 6400 litre / 1690.70 gallon (35hr) UL fuel tank with secondary fluid containment in separate fuel compartment
- Internal fuel fill point and gauge
- Three way fuel valve with single lever operation to permit operation from external fuel supply
- Dual stage fuel filter with water separator

General :

- Works test in general compliance with ISO standards
- Set of operation & maintenance manuals
- JCB Power Products standard colour - container (RAL9001), cream
- Engine, alternator & radiator supplied in manufacturer colours
- CSA compliant

KEY MECHANICAL & ELECTRICAL OPTIONS

Engine & Cooling :

- Air shut off valve (refinery specification)
- Jacket water heater
- Heavy duty air cleaner
- Crankcase breather recirculation system

Fuel System :

- Low fuel level alarm / shutdown
- Fluid containment alarm / shutdown

Exhaust :

- DNV certified spark arrestor (refinery specification)

Container :

- Custom colour

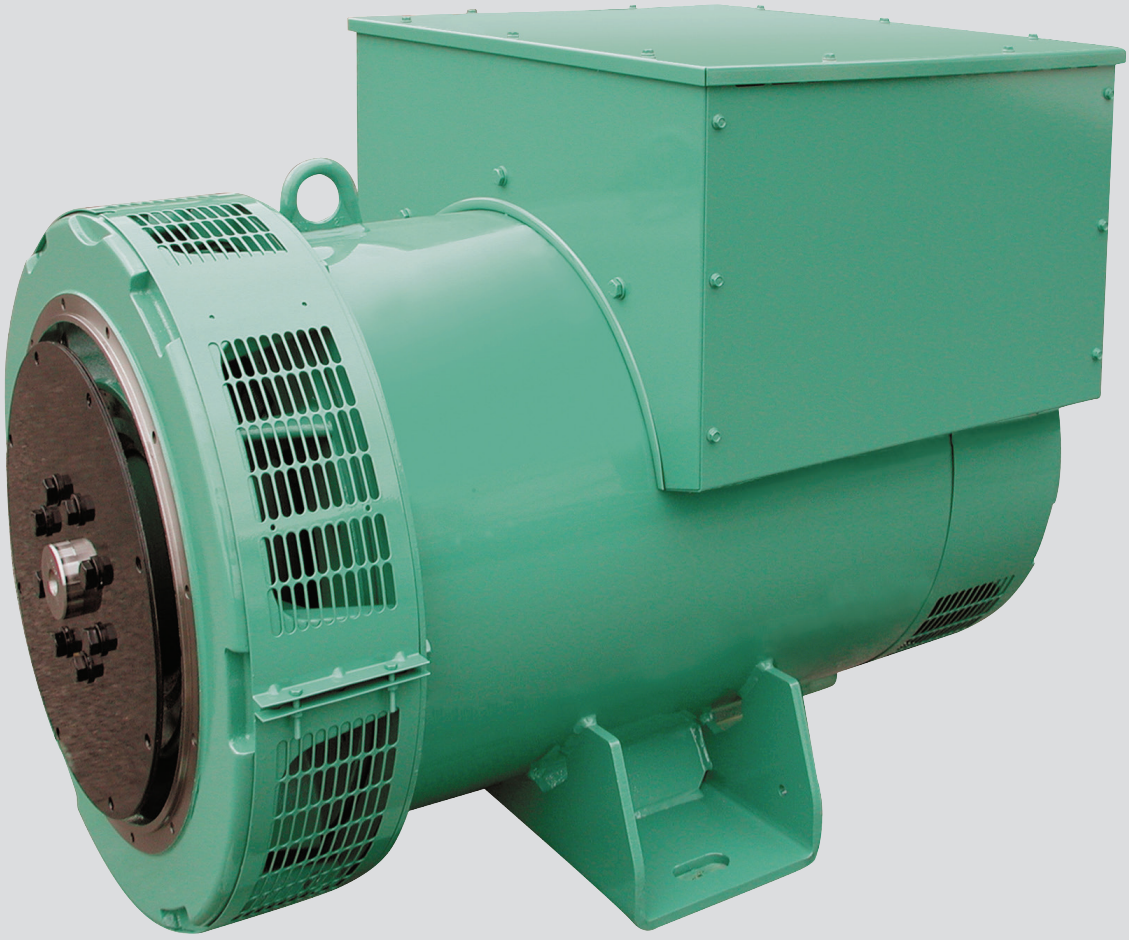
Alternator :

- Anti-condensation heater
- Quadrature droop kit
- 3 phase sensing ± 0.5% voltage regulation

Electrical :

- 2 position voltage selection for 480/277V, 208/120V
- DSE 8610 controller
- DEIF AGC-4 controller
- Rotary synchronising switch - up to 4 generators
- Adjustable / key switchable earth leakage
- Static 5 Amp battery charger
- Cam-lock connectors

Please refer to JCB Power Products for full details of these and other options.



LSA 47.2

Low Voltage Alternator - 4 pole

365 to 600 kVA - 50 Hz / 456 to 750 kVA - 60 Hz
Electrical and mechanical data

LEROY-SOMER™

Nidec
All for dreams

Specially adapted to applications

The LSA 47.2 alternator is designed to be suitable for typical generator applications, such as: backup, prime power, cogeneration, marine applications, rental, telecommunications, etc.

Compliant with international standards

The LSA 47.2 alternator conforms to the main international standards and regulations:
- IEC 60034, NEMA MG 1.32-33, ISO 8528-3, CSA C22.2 n°100-14, UL 1446 (UL 1004 on request), marine regulations, etc.

It can be integrated into a CE marked generator.
The LSA 47.2 is designed, manufactured and marketed in an ISO 9001 and ISO 14001 environment.

Top of the range electrical performance

- Class H insulation
- Standard 12-wire re-connectable winding, 2/3 pitch, type no. 6 (the LSA 47.2 L9 is available in two versions: 6-wire and 12-wire)
- Voltage range 50 Hz: 220 V - 240 V and 380 V - 415 V (440 V)
- Voltage range 60 Hz: 208 V - 240 V and 380 V - 480 V
- High efficiency and motor starting capacity
- Other voltages are possible with optional adapted windings:
  - 50 Hz : 440 V (no. 7), 500 V (no. 9), 600 V (no. 23), 690 V (no. 52)
  - 60 Hz : 380 V and 416 V (no. 8), 600 V (no. 9)
- R 791 interference suppression conforming to standard EN 61000-6-3, EN 61000-6-2, EN 55011 group 1 class B standard for European zone (CE marking)

Excitation and regulation system suited to the application

Excitation system				Regulation options				
Volage regulator	**SHUNT**	**AREP** (option)	**PMG** (option)	**C.T.** Current transformer for paralleling	Mains paralleling	3-phase sensing	3-phase sensing for mains paralleling unbalanced	Remote voltage potentiometer
R250	**Standard**	**-**	**-**	**-**	**-**	**-**	**-**	√
D350	**-**	**Standard**	**Standard**	**C.T.**	**-**	√	√	√
D510C	**Option**	**Option**	**Option**	**C.T.**	√	√	√	√

√ : Possible option

Protection system suited to the environment

- The LSA 47.2 is IP 23
- Standard winding protection for clean environments with relative humidity ≤ 95 %, including indoor marine environments

Options :
- Filters on air inlet : derating 5%
- Filters on air inlet and air outlet (IP 44) : derating 10%
- Winding protections for harsh environments and relative humidity greater than 95%
- Space heaters
- Thermal protection for windings and shields

Reinforced mechanical structure using finite element modelling

- Compact and rigid assembly to better withstand generator vibrations
- Steel frame
- Cast iron flanges and shields
- Twin-bearing and single-bearing versions designed to be suitable for engines on the market
- Half-key balancing
- Sealed for life ball bearings, regreasable bearings (optional)
- Standard direction of rotation : clockwise when looking at the drive end view (for anti-clockwise, derate the machine by 5%)

Accessible terminal box proportioned for optional equipment

- Easy access to the voltage regulator and to the connections
- Possible inclusion of accessories for paralleling, protection and measurement
- 9-way terminal block for voltage reconnection

General characteristics

Insulation class	H
Winding pitch	2/3 (N° 6 or N° 6S)
Number of wires	12 (N° 6) / 6 (N° 6S)
Protection	IP 23
Altitude	≤ 1000 m
Overspeed	2250 min^{-1}
Air flow	0.9 m^3/s (50Hz) / 1.1 (60Hz)

Excitation system	SHUNT (12 wire)	AREP / PMG
AVR type	R250	D350
Voltage regulation (*)	± 0.5%	± 0.25%
Short-circuit current	-	300% (3 IN) : 10s
Total Harmonic distortion THD (**)	no load < 1.5% - on load < 2%	
Waveform: NEMA = TIF (**)	< 50	

(*) Steady state (**) Total harmonic distortion between phases, no-load or on-load (non-distorting)

Ratings 50 Hz - 1500 R.P.M.

kVA / kW - P.F. = 0.8

Duty/T°C		Continuous duty/40°C			Continuous duty/40°C			Stand-by/40°C			Stand-by/27°C		
Class/T°K		H/125°K			F/105°K			H/150°K			H/163°K		
Phase		**3 ph.**			**3 ph.**			**3 ph.**			**3 ph.**		
Y		380V	400V	415V	380V	400V	415V	380V	400V	415V	380V	400V	415V
Δ		220V	230V	240V	220V	230V	240V	220V	230V	240V	220V	230V	240V
Y Y			200V			200V			200V			200V	
12 wires version													
LSA 47.2 VS2	kVA		**365**			330			405			**420**	
	kW		***292***			*264*			*324*			***336***	
LSA 47.2 S4	kVA		**410**			370			430			**450**	
	kW		***328***			*296*			*344*			***360***	
LSA 47.2 S5	kVA		**455**			405			471			**500**	
	kW		***364***			*324*			*377*			***400***	
LSA 47.2 M7	kVA		**500**			465			550			**570**	
	kW		***400***			*372*			*440*			***456***	
LSA 47.2 M8	kVA		**550**			500			575			**600**	
	kW		***440***			*400*			*460*			***480***	
LSA 47.2 L9	kVA		**600**			535			630			**660**	
	kW		***480***			*428*			*504*			***528***	
6 wires version													
Y		380V	400V	415V	380V	400V	415V	380V	400V	415V	380V	400V	415V
Δ		220V	230V	240V	220V	230V	240V	220V	230V	240V	220V	230V	240V
LSA 47.9 L9*	kVA		**600**			535			630			**660**	
	kW		***480***			*428*			*504*			***528***	

Ratings 60 Hz - 1800 R.P.M.

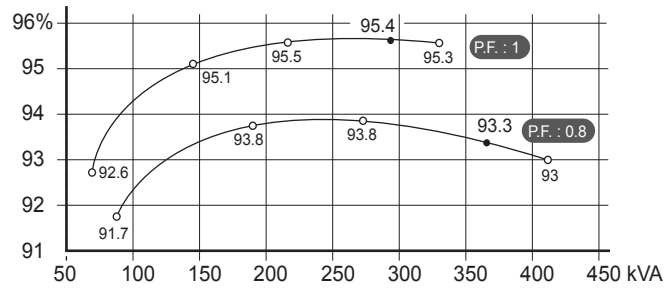
kVA / kW - P.F. = 0.8

Duty/T°C		Continuous duty/40°C				Continuous duty/40°C				Stand-by/40°C				Stand-by/27°C			
Class/T°K		H/125°K				F/105°K				H/150°K				H/163°K			
Phase		**3 ph.**				**3 ph.**				**3 ph.**				**3 ph.**			
Y		380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V
Δ		220V	240V			220V	240V			220V	240V			220V	240V		
Y Y			208V	220V	240V		208V	220V	240V		208V	220V	240V		208V	220V	240V
12 wires version																	
LSA 47.2 VS2	kVA	424	454	456	**456**	394	410	410	410	451	483	500	511	469	500	518	**530**
	kW	*339*	*363*	*365*	***365***	*315*	*328*	*328*	*328*	*361*	*386*	*400*	*409*	*375*	*400*	*414*	***424***
LSA 47.2 S4	kVA	450	480	500	**512**	396	442	442	465	475	513	533	550	500	530	550	**581**
	kW	*360*	*384*	*400*	***410***	*317*	*354*	*354*	*372*	*380*	*410*	*426*	*440*	*400*	*424*	*440*	***465***
LSA 47.2 S5	kVA	475	510	531	**570**	441	473	493	518	503	543	566	592	527	562	585	**625**
	kW	*380*	*408*	*425*	***456***	*353*	*378*	*394*	*414*	*402*	*434*	*453*	*474*	*422*	*450*	*468*	***500***
LSA 47.2 M7	kVA	562	610	625	**625**	523	566	581	590	600	651	669	680	625	668	690	**700**
	kW	*450*	*488*	*500*	***500***	*418*	*453*	*465*	*472*	*480*	*521*	*535*	*554*	*500*	*534*	*552*	***560***
LSA 47.2 M8	kVA	562	610	630	**690**	523	566	587	632	600	651	672	729	625	671	705	**750**
	kW	*450*	*488*	*504*	***552***	*418*	*453*	*470*	*506*	*480*	*521*	*538*	*583*	*500*	*537*	*564*	***600***
LSA 47.2 L9	kVA	602	661	685	**750**	556	609	634	675	643	707	734	780	667	728	763	**825**
	kW	*482*	*529*	*548*	***600***	*445*	*487*	*507*	*540*	*514*	*566*	*587*	*624*	*534*	*582*	*610*	***660***
6 wires version																	
Y		380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V
Δ		220V	240V			220V	240V			220V	240V			220V	240V		
LSA 47.2 L9*	kVA	602	661	685	**750**	556	609	634	675	643	707	734	780	667	728	763	**825**
	kW	*482*	*529*	*548*	***600***	*445*	*487*	*507*	*540*	*514*	*566*	*587*	*624*	*534*	*582*	*610*	***660***

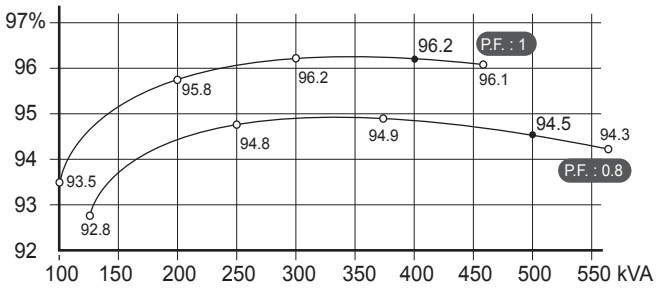
** AREP excitation only*

Efficiencies 400 V - 50 Hz (P.F.: 1) (P.F.: 0.8)

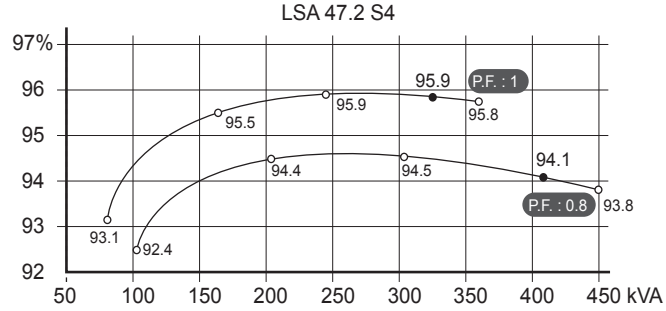
LSA 47.2 VS 2



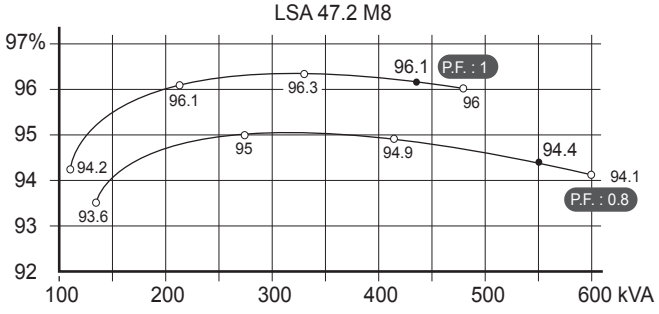
LSA 47.2 M7



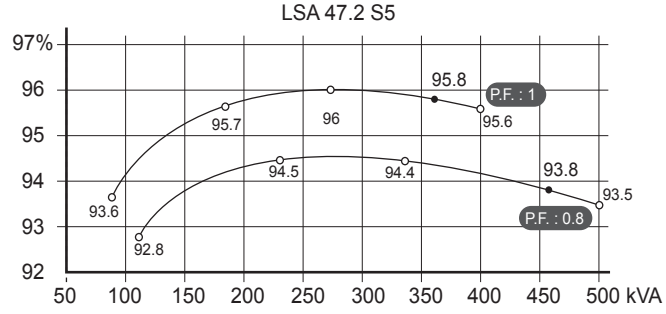
LSA 47.2 S4



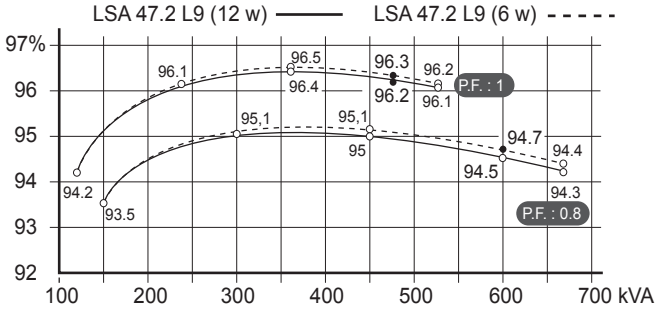
LSA 47.2 M8



LSA 47.2 S5



LSA 47.2 L9 (12 w) ——— LSA 47.2 L9 (6 w) - - - - -

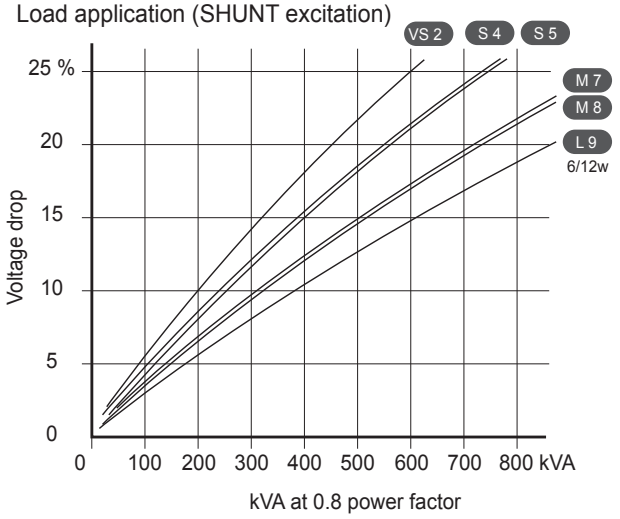


Reactances (%). Time constants (ms) - Class H / 400 V

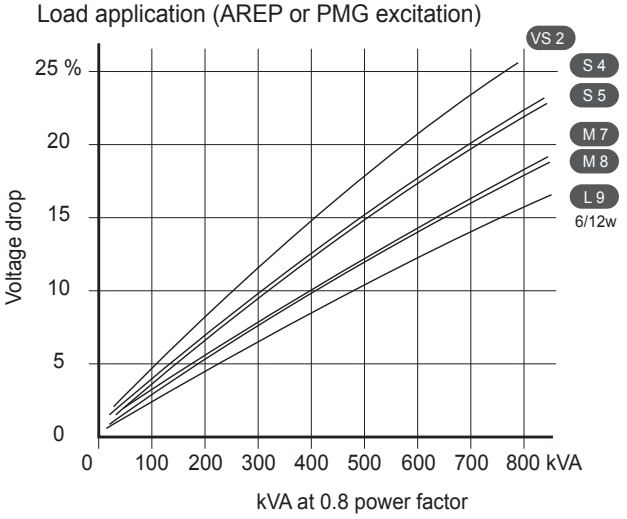
		VS2 (12w)	S4 (12w)	S5 (12w)	M7 (12w)	M8 (12w)	L9 (12w)	L9 (6w)
Kcc	Short-circuit ratio	0.38	0.37	0.33	0.41	0.32	0.37	0.38
Xd	Direct-axis synchro. reactance unsaturated	336	322	357	307	360	330	325
Xq	Quadrature-axis synchro. reactance unsaturated	201	193	214	184	216	198	195
T'do	No-load transient time constant	1738	1855	1855	1930	1958	1997	1997
X'd	Direct-axis transient reactance saturated	19.3	17.3	19.2	15.9	18.3	16.5	16.2
T'd	Short-circuit transient time constant	100	100	100	100	100	100	100
X"d	Direct-axis subtransient reactance saturated	13.5	12.1	13.5	11.1	12.9	11.4	11.6
T"d	Subtransient time constant	10	10	10	10	10	10	10
X"q	Quadrature-axis subtransient reactance saturated	18.4	16.3	18	14.7	17	15	15.2
Xo	Zero sequence reactance unsaturated	0.9	0.9	0.9	0.7	0.6	0.9	0.2
X2	Negative sequence reactance saturated	16	14.2	15.8	13	15	13.2	13.4
Ta	Armature time constant	15	15	15	15	15	15	15
Other class H/400 V data								
io (A)	No-load excitation current	1	0.9	0.9	1	0.9	0.9	0.9
ic (A)	On-load excitation current	3.8	3.5	3.8	3.6	3.7	3.7	3.7
uc (V)	On-load excitation voltage	39	35	38	36	37	36	36
ms	Response time (ΔU = 20% transient)	500	500	500	500	500	500	500
kVA	Start (ΔU = 20% cont. or 50% trans.) SHUNT	722	928	928	1073	1159	1258	1258
kVA	Start (ΔU = 20% cont. or 50% trans.) AREP	805	1035	1035	1195	1294	1400	1400
%	Transient ΔU (on-load 4/4) SHUNT - P.F.: 0.8 $_{LAG}$	16.8	15.5	16.7	14.6	16.2	15	14.8
%	Transient ΔU (on-load 4/4) AREP - P.F.: 0.8 $_{LAG}$	13.7	12.7	13.6	11.9	13.2	12.2	12.1
W	No-load losses	5440	5690	5690	6540	6120	6780	6880
W	Heat dissipation	20780	20470	23780	23040	26020	27490	26720

Transient voltage variation 400V - 50 Hz

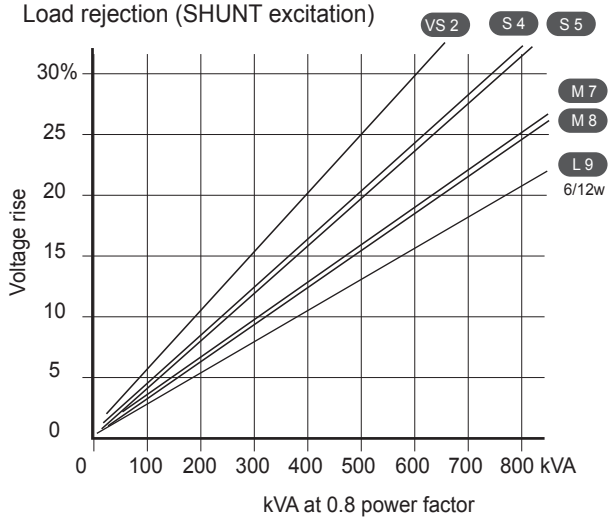
Load application (SHUNT excitation)



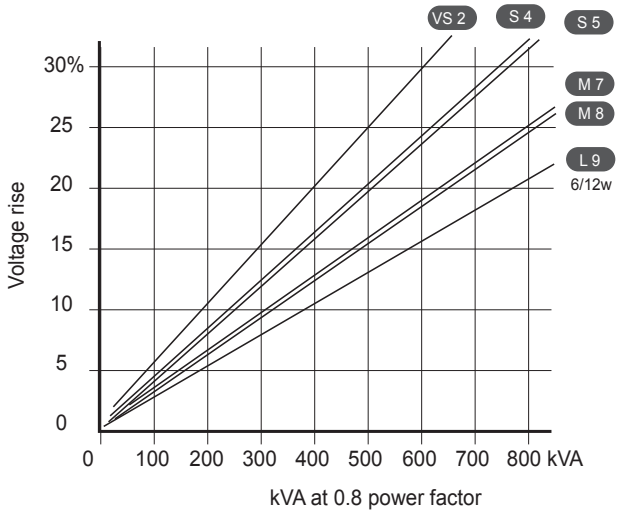
Load application (AREP or PMG excitation)



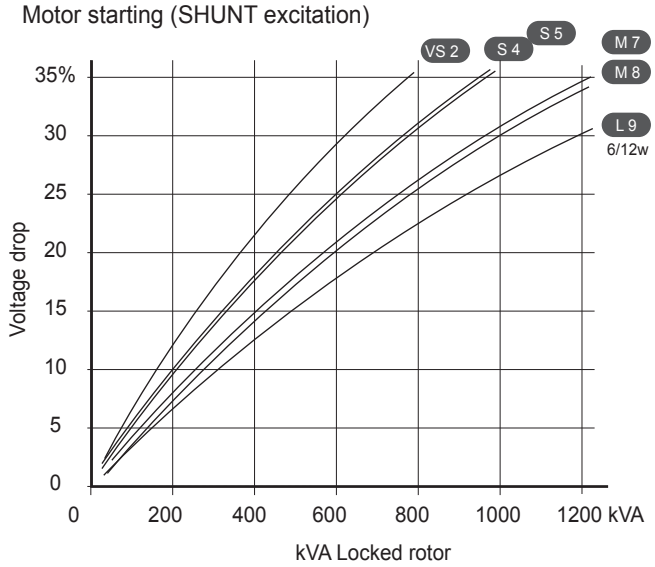
Load rejection (SHUNT excitation)



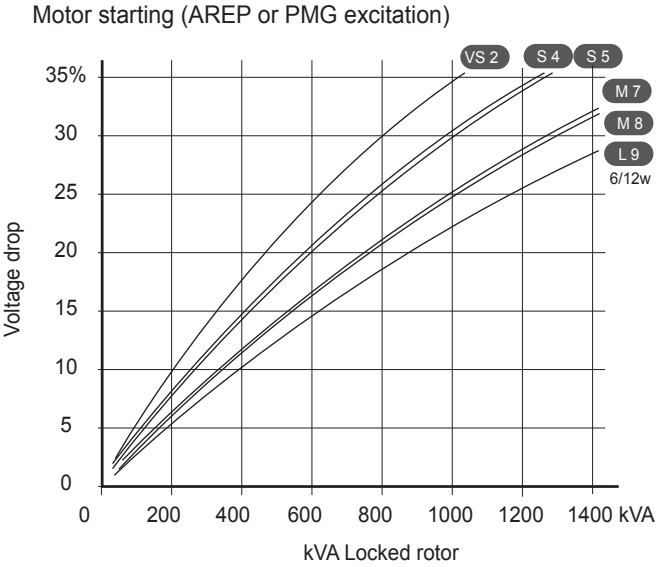
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)

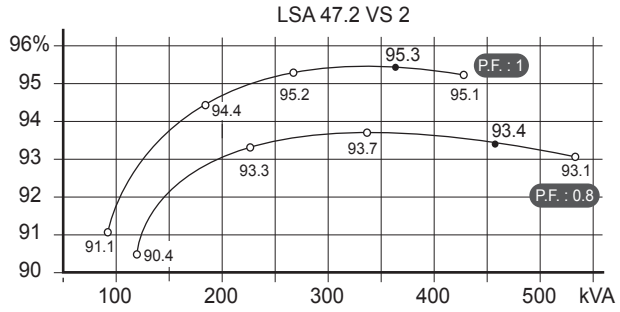


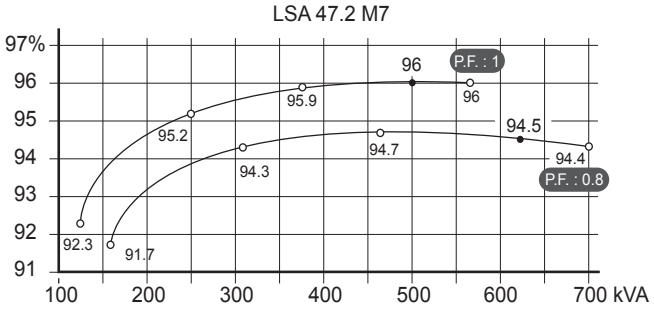
Motor starting (AREP or PMG excitation)

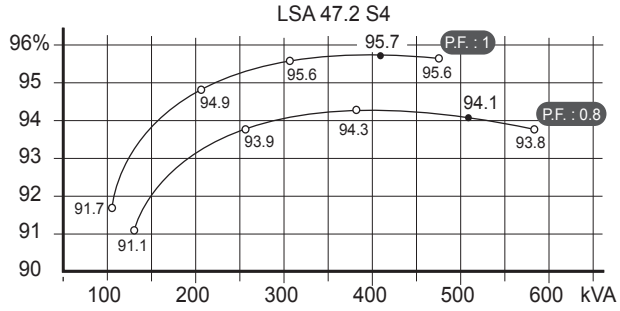


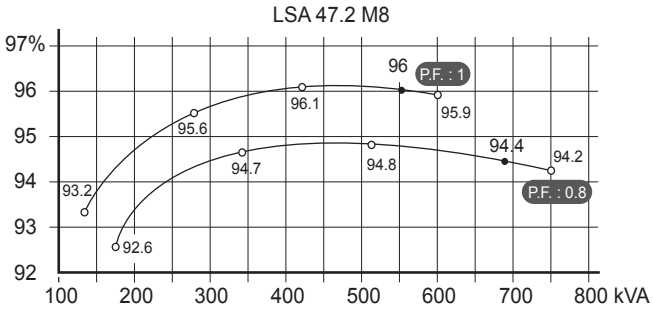
1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by K = Sine P.F. / 0.8
2) For voltages other than 400V (Y), 230V (Δ) at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

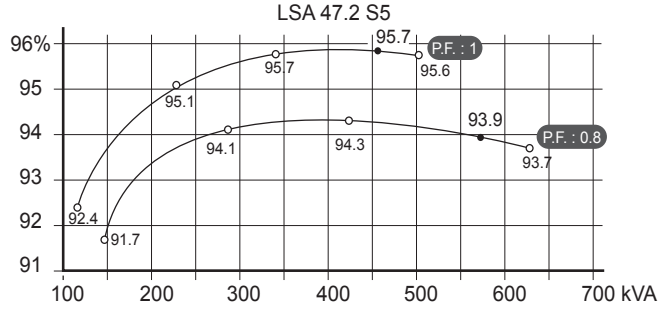
Efficiencies 480 V - 60 Hz (P.F.: 1) (P.F.: 0.8)

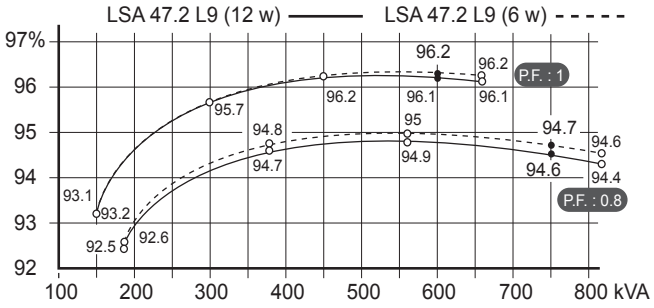










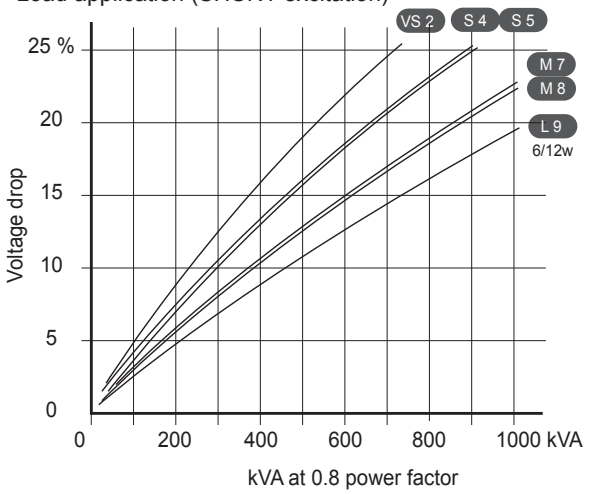


Reactances (%). Time constants (ms) - Class H / 480 V

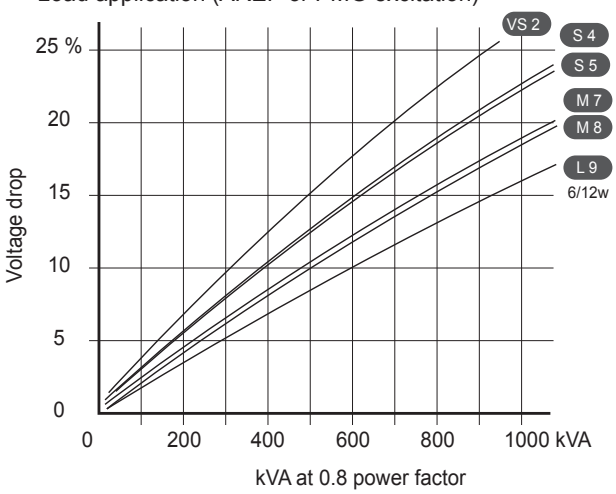
		VS2 (12w)	S4 (12w)	S5 (12w)	M7 (12w)	M8 (12w)	L9 (12w)	L9 (6w)
Kcc	Short-circuit ratio	0.36	0.36	0.32	0.40	0.31	0.35	0.36
Xd	Direct-axis synchro. reactance unsaturated	349	335	373	319	376	344	338
Xq	Quadrature-axis synchro. reactance unsaturated	209	201	223	191	225	206	203
T'do	No-load transient time constant	1738	1855	1855	1930	1958	1997	1997
X'd	Direct-axis transient reactance saturated	20.1	18	20.1	16.5	19.2	17.2	16.9
T'd	Short-circuit transient time constant	100	100	100	100	100	100	100
X"d	Direct-axis subtransient reactance saturated	14.1	12.6	14	11.6	13.4	11.8	12.1
T"d	Subtransient time constant	10	10	10	10	10	10	10
X"q	Quadrature-axis subtransient reactance saturated	19.1	16.9	18.8	15.3	17.8	15.6	15.8
Xo	Zero sequence reactance unsaturated	0.1	0.4	0.1	0.1	0.9	0.9	0.4
X2	Negative sequence reactance saturated	16.6	14.8	16.5	13.5	15.6	13.7	14
Ta	Armature time constant	15	15	15	15	15	15	15
Other class H/480 V data								
io (A)	No-load excitation current	1	0.9	0.9	1	0.9	0.9	0.9
ic (A)	On-load excitation current	3.9	3.5	3.9	3.7	3.8	3.7	3.7
uc (V)	On-load excitation voltage	40	35	39	37	38	37	37
ms	Response time (ΔU = 20% transient)	500	500	500	500	500	500	500
kVA	Start (ΔU = 20% cont. or 50% trans.) SHUNT	890	1136	1136	1318	1433	1550	1554
kVA	Start (ΔU = 20% cont. or 50% trans.) AREP	994	1271	1271	1473	1606	1733	1737
%	Transient ΔU (on-load 4/4) SHUNT - P.F.: 0.8 $_{LAG}$	17.3	16	17.3	15	16.7	15.5	15.3
%	Transient ΔU (on-load 4/4) AREP - P.F.: 0.8 $_{LAG}$	14.1	13	14.1	12.2	13.6	12.6	12.4
W	No-load losses	8540	8910	8910	10080	9530	10440	10580
W	Heat dissipation	25650	25650	29340	28630	32190	33870	33010

Transient voltage variation 480V - 60 Hz

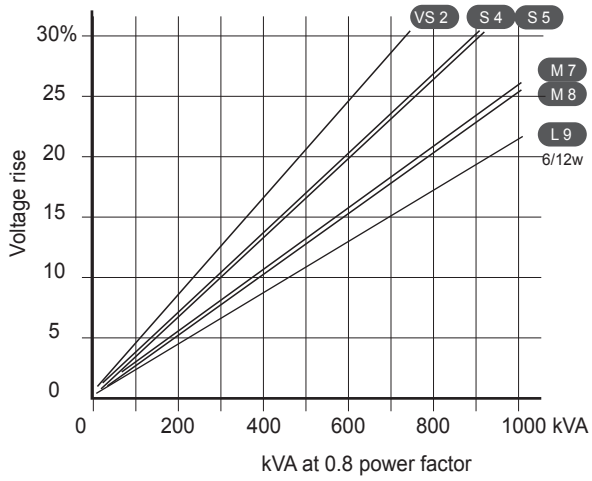
Load application (SHUNT excitation)



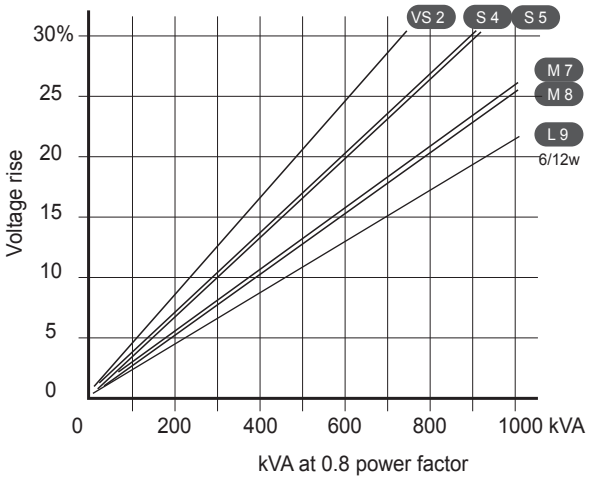
Load application (AREP or PMG excitation)



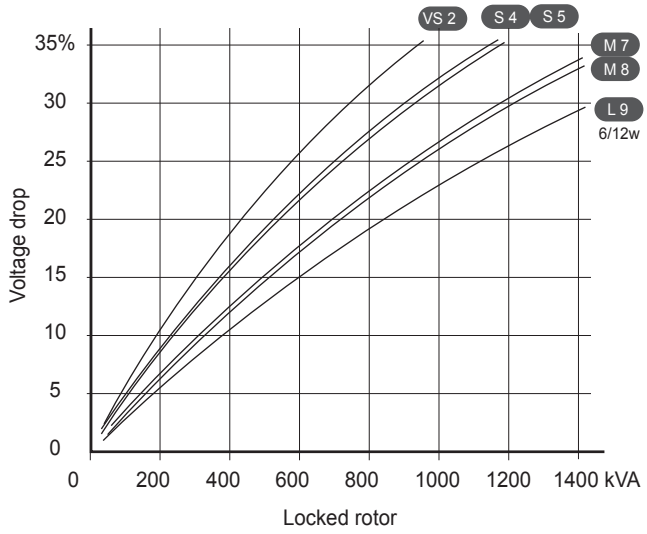
Load rejection (SHUNT excitation)



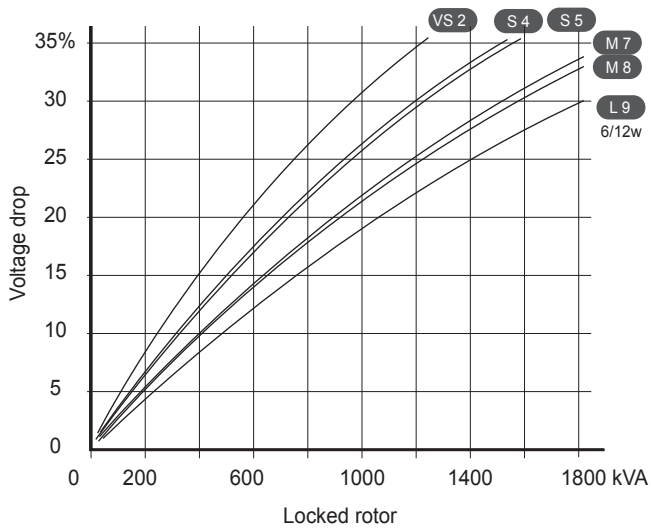
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



Motor starting (AREP or PMG excitation)

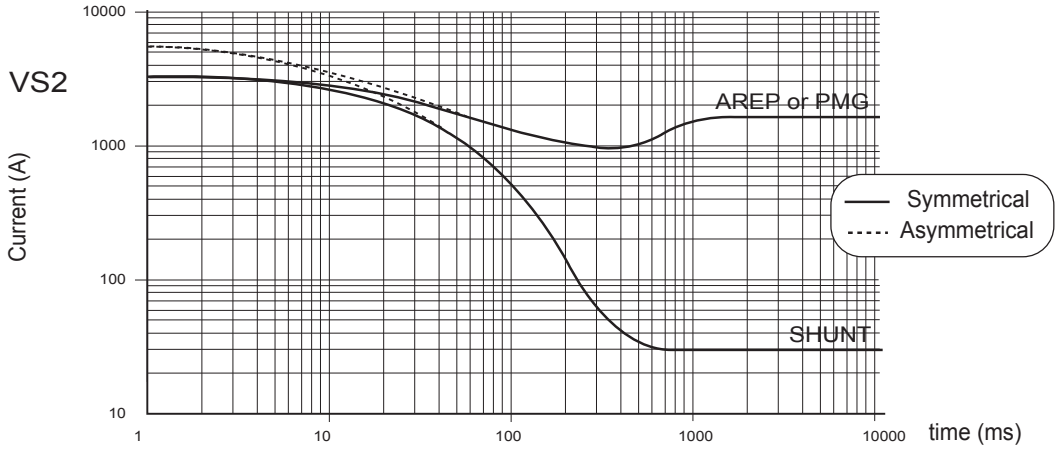


1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by K = Sine P.F. / 0.8

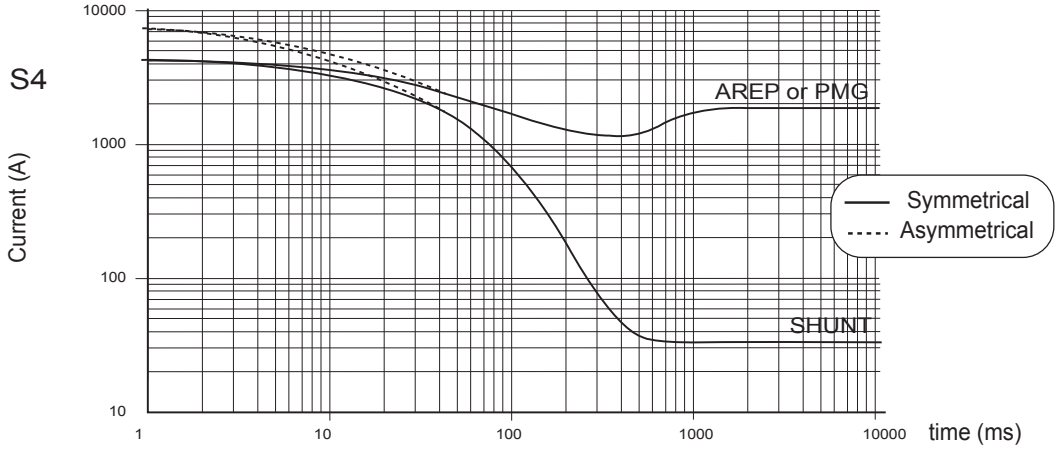
2) For voltages other than 480V (Y), 277V (Δ), 240V (YY) at 60 Hz, then kVA must be multiplied by $(480/U)^2$ or $(277/U)^2$ or $(240/U)^2$.

3-phase short-circuit curves at no load and rated speed (star connection Y)

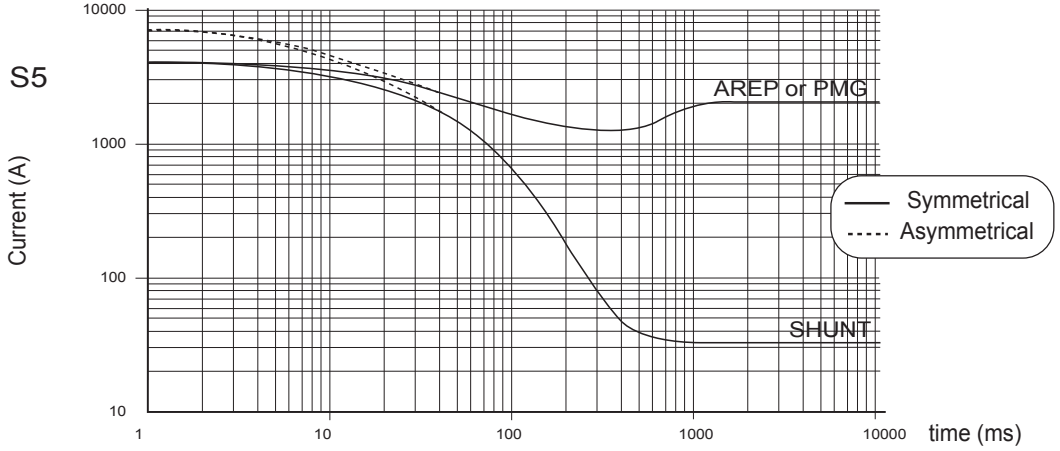
LSA 47.2 VS2



LSA 47.2 S4



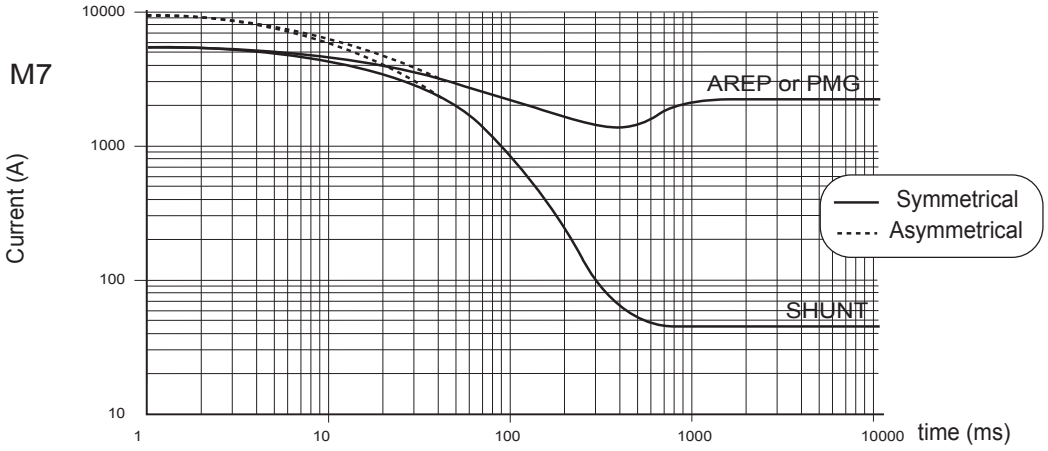
LSA 47.2 S5



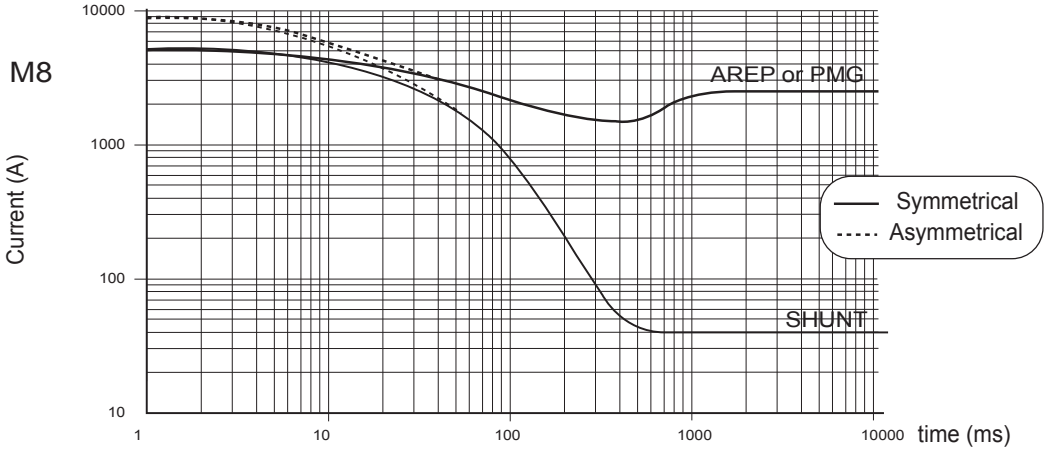
Influence due to connection
Curves shown are for star (Y) connection.
For other connections, use the following multiplication factors:
- Series delta : current value x 1.732 - Parallel star : current value x 2

3-phase short-circuit curves at no load and rated speed (star connection Y)

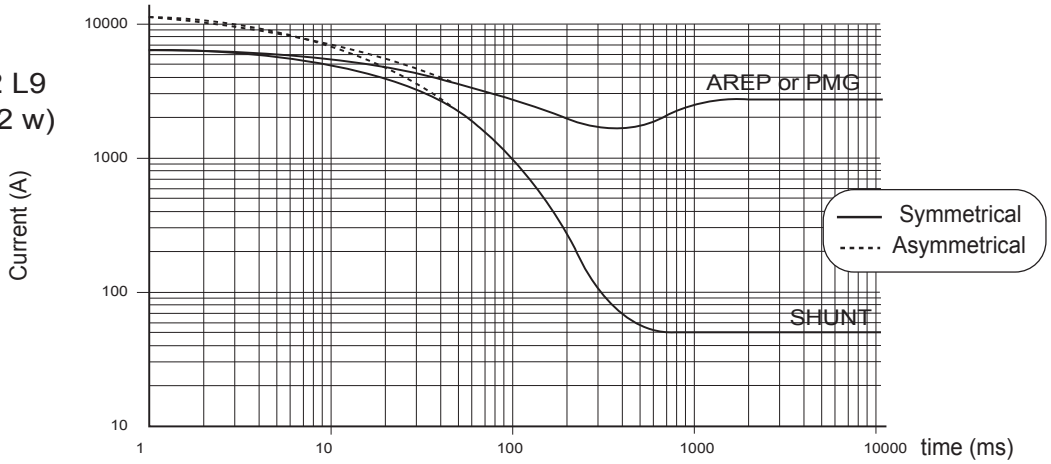
LSA 47.2 M7



LSA 47.2 M8



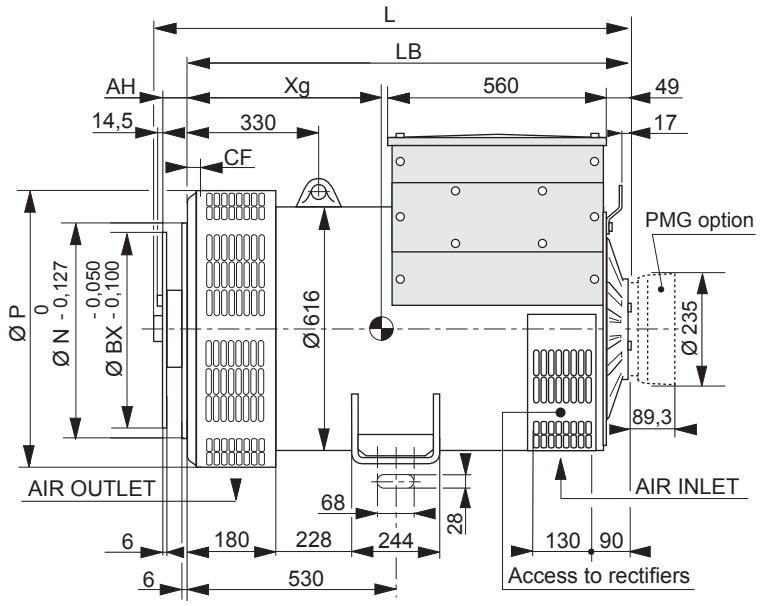
LSA 47.2 L9
(6w / 12 w)

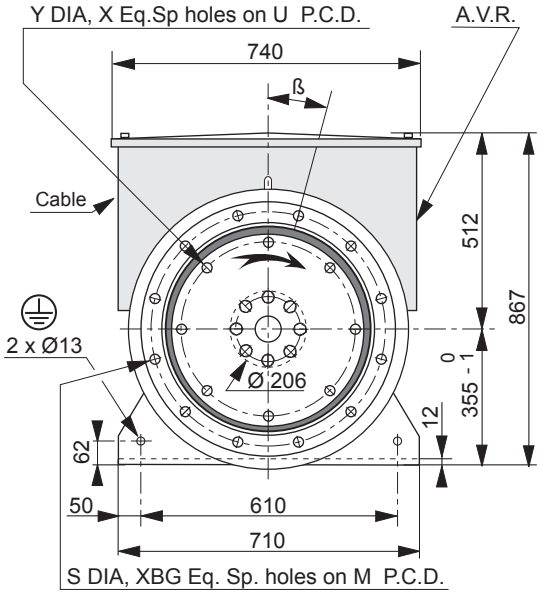


Influence due to short-circuit
Curves are based on a three-phase short-circuit.
For other types of short-circuit, use the following multiplication factors.

	3-phase	2-phase L/L	1-phase L/N
Instantaneous (max.)	1	0.87	1.3
Continuous	1	1.5	2.2
Maximum duration (AREP/PMG)	10 sec.	5 sec.	2 sec.

Single bearing dimensions





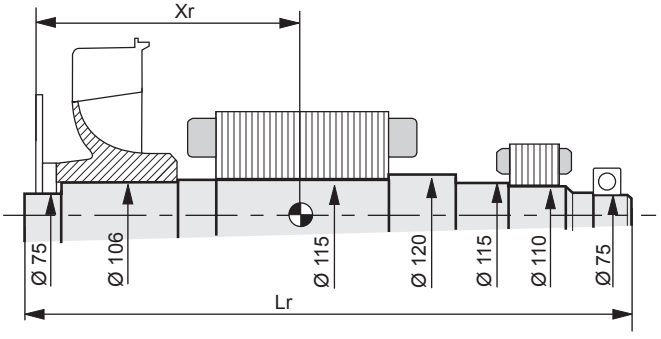
Dimensions (mm) and weight				
Type	L without PMG	LB	Xg	Weight (kg)
LSA 47.2 VS2	1041	996	437	976
LSA 47.2 S4	1101	1056	471	1113
LSA 47.2 S5	1101	1056	471	1113
LSA 47.2 M7	1201	1156	511	1240
LSA 47.2 M8	1201	1156	520	1289
LSA 47.2 L9	1221	1176	545	1372

Coupling			
Flex plate	11 1/2	14	18
Flange S.A.E 1	X	X	
Flange S.A.E 1/2		X	
Flange S.A.E 0		X	X

Flange (mm)							
S.A.E.	P	N	M	XBG	S	β°	CF
1	713	511.175	530.225	12	12	15°	15
1/2	713	584.2	619.125	12	14	15°	22
0	713	647.7	679.45	16	14	11° 15'	42

Flex plate (mm)					
S.A.E.	BX	U	X	Y	AH
11 1/2	352.42	333.38	8	11	39.6
14	466.72	438.15	8	14	25.4
18	571.5	542.92	6	17	15.7

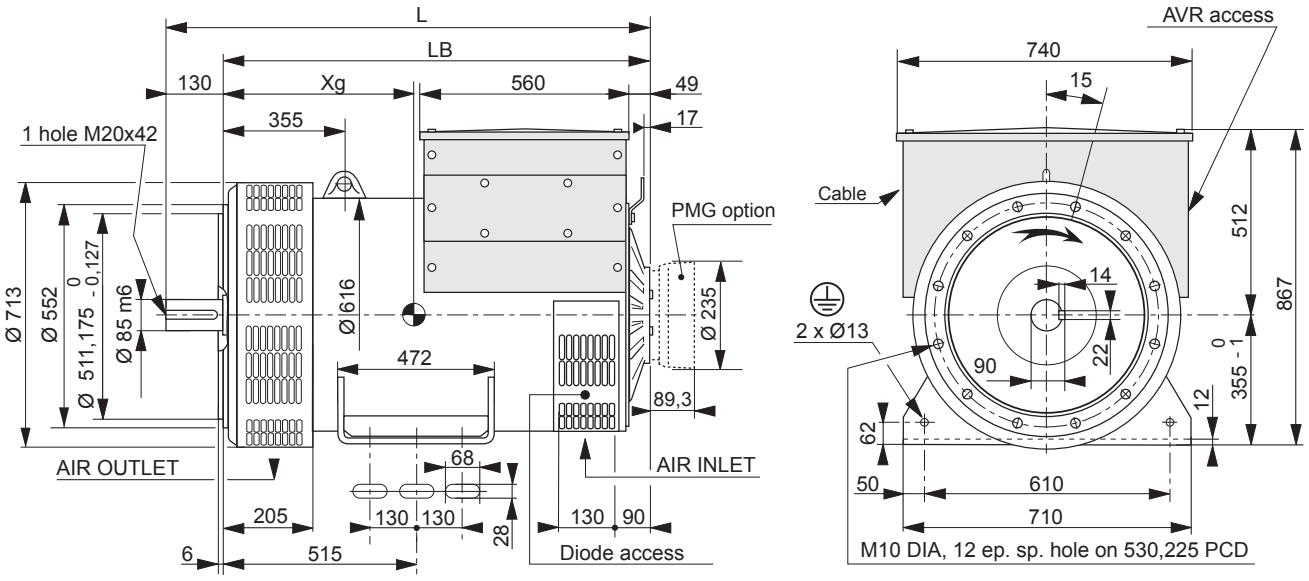
Torsional analysis data



Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm²): (4J = MD²)												
Flex plate	S.A.E. 11 1/2				S.A.E. 14				S.A.E. 18			
Type	Xr	Lr	M	J	Xr	Lr	M	J	Xr	Lr	M	J
LSA 47.2 VS2	432.5	1029	387	5.99	418.3	1029	387	6.12	408.5	1029	387	6.38
LSA 47.2 S4	470	1089	442	6.90	456	1089	442	7.03	446	1089	442	7.29
LSA 47.2 S5	470	1089	442	6.90	456	1089	442	7.03	446	1089	442	7.29
LSA 47.2 M7	510	1189	495	7.61	496	1189	495	7.74	486	1189	495	8
LSA 47.2 M8	521	1189	514	8.01	507	1189	514	8.14	497	1189	514	8.40
LSA 47.2 L9	542	1209	547	8.52	528	1209	547	8.65	518	1209	547	8.91

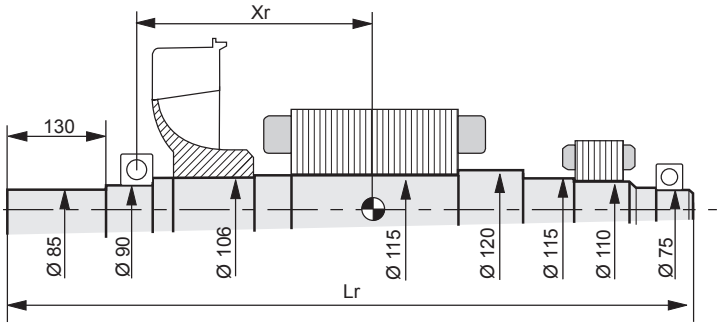
NOTE : Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.
The torsional analysis of the transmission is imperative. All values are available upon request.

Two bearing dimensions



Dimensions (mm) and weight				
Type	L without PMG	LB	Xg	Weight (kg)
LSA 47.2 VS2	1151	1021	457	996
LSA 47.2 S4	1211	1081	491	1126
LSA 47.2 S5	1211	1081	491	1126
LSA 47.2 M7	1311	1181	531	1253
LSA 47.2 M8	1311	1181	531	1302
LSA 47.2 L9	1331	1201	565	1392

Torsional analysis data



Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm²): (4J = MD²)				
Type	Xr	Lr	M	J
LSA 47.2 VS2	396.4	1139	368.5	5.79
LSA 47.2 S4	433.2	1199	424	6.70
LSA 47.2 S5	433.2	1199	424	6.70
LSA 47.2 M7	473	1299	476.2	7.41
LSA 47.2 M8	483.5	1299	494.9	7.81
LSA 47.2 L9	504.5	1319	528	8.32

NOTE : Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.
The torsional analysis of the transmission is imperative. All values are available upon request.

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Capital social : 65 800 512 €, RCS Angoulême 338 567 258.

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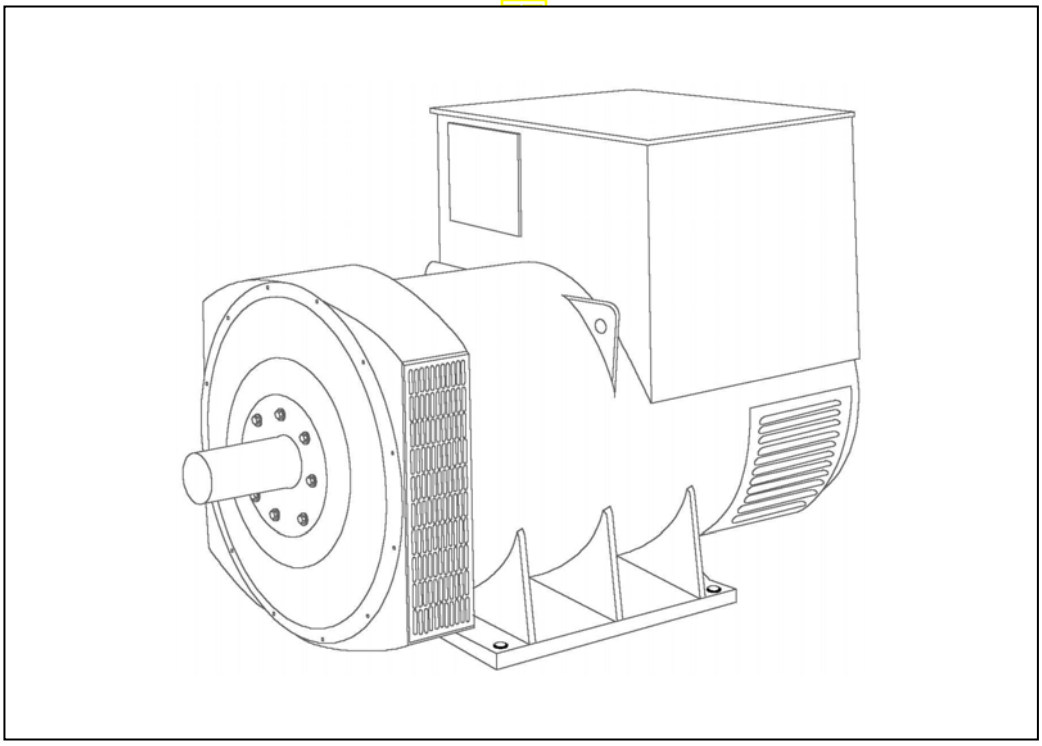
STAMFORD®

HCI634J - 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.

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.

HCI634J

STAMFORD

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)	

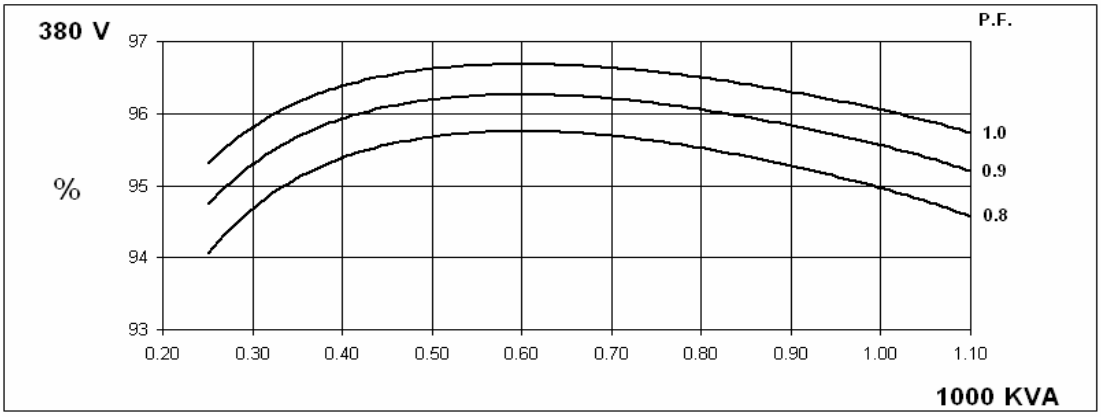
INSULATION SYSTEM	CLASS H							
PROTECTION	IP23							
RATED POWER FACTOR	0.8							
STATOR WINDING	DOUBLE LAYER LAP							
WINDING PITCH	TWO THIRDS							
WINDING LEADS	6 (Wdg 312) or 12 (Wdg 311)							
STATOR WDG. RESISTANCE	0.002 Ohms PER PHASE AT 22°C STAR CONNECTED							
ROTOR WDG. RESISTANCE	2.09 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	2279 kg				2300 kg			
WEIGHT WOUND STATOR	1120 kg				1120 kg			
WEIGHT WOUND ROTOR	962 kg				916 kg			
WR² INERTIA	22.9287 kgm^2				22.3814 kgm^2			
SHIPPING WEIGHTS in a crate	2328kg				2329kg			
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	1000	1030	1030	1000	1150	1200	1250	1300
Xd DIR. AXIS SYNCHRONOUS	3.02	2.81	2.61	2.25	3.49	3.25	3.10	2.96
X'd DIR. AXIS TRANSIENT	0.24	0.23	0.21	0.18	0.28	0.26	0.25	0.24
X"d DIR. AXIS SUBTRANSIENT	0.17	0.15	0.14	0.12	0.19	0.18	0.17	0.16
Xq QUAD. AXIS REACTANCE	1.78	1.66	1.54	1.33	2.05	1.91	1.82	1.74
X"q QUAD. AXIS SUBTRANSIENT	0.21	0.20	0.19	0.16	0.25	0.23	0.22	0.21
X_L LEAKAGE REACTANCE	0.09	0.08	0.07	0.07	0.10	0.10	0.09	0.09
X_2 NEGATIVE SEQUENCE	0.21	0.20	0.19	0.16	0.25	0.23	0.22	0.21
X_0 ZERO SEQUENCE	0.03	0.02	0.02	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.	3.03							
Ta ARMATURE TIME CONST.	0.046							
SHORT CIRCUIT RATIO	1/Xd							

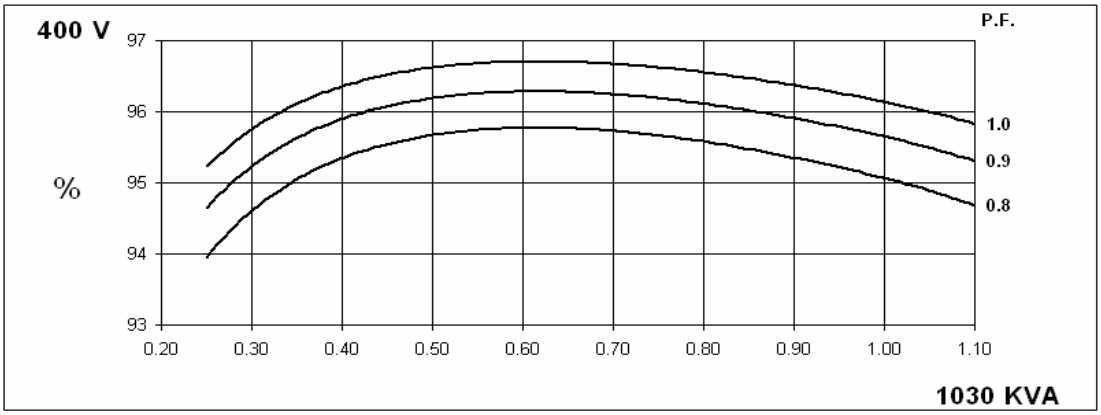
50 Hz

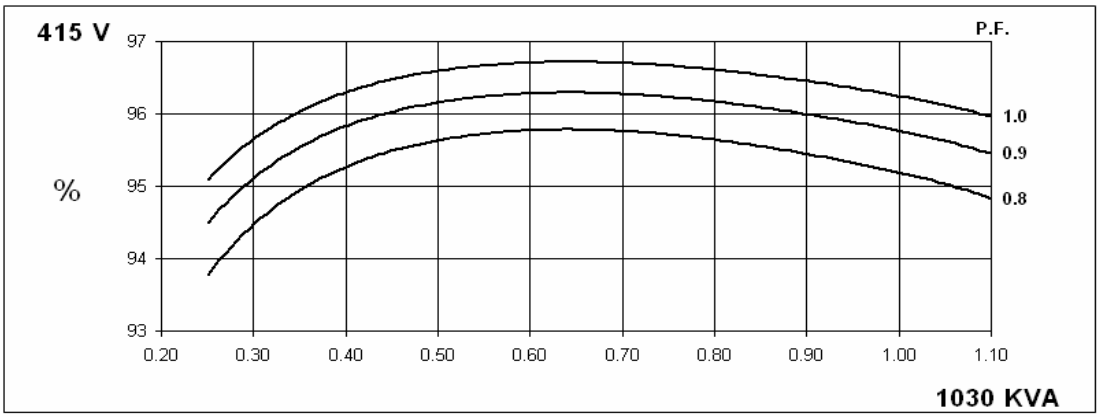
HCI634J

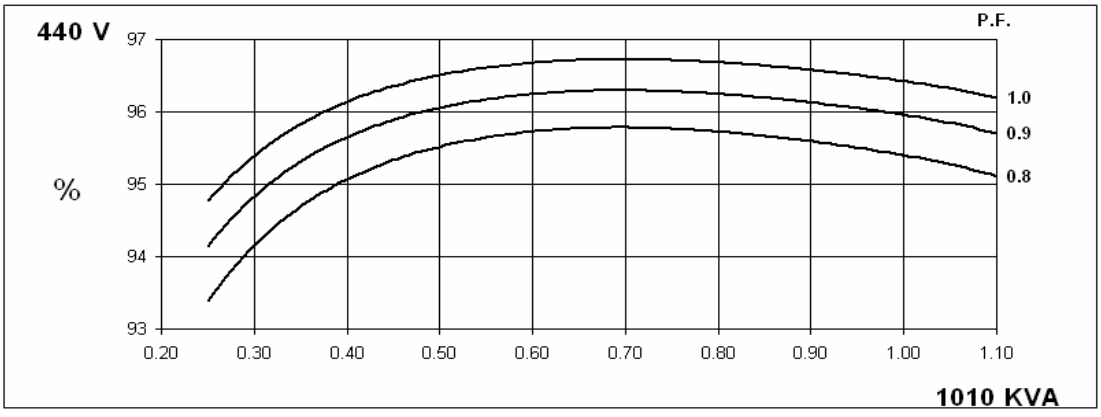
WINDING 311 and 312

THREE PHASE EFFICIENCY CURVES









60 Hz

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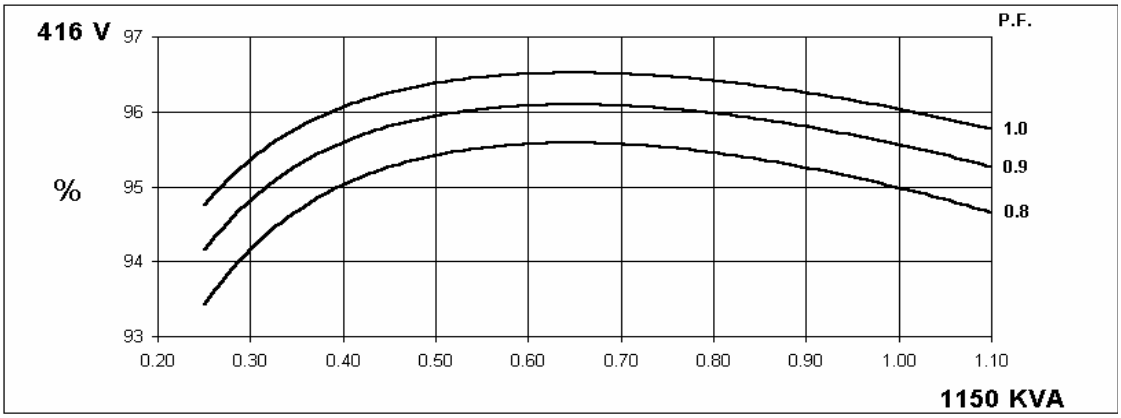
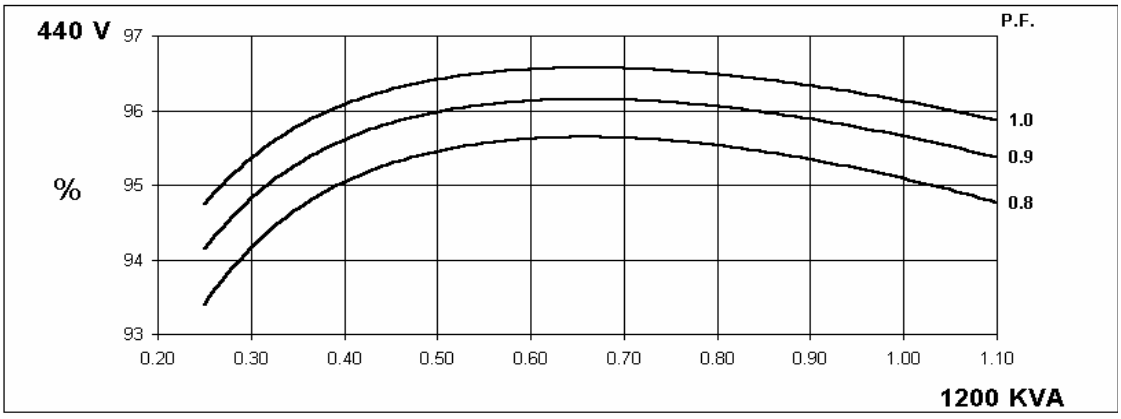
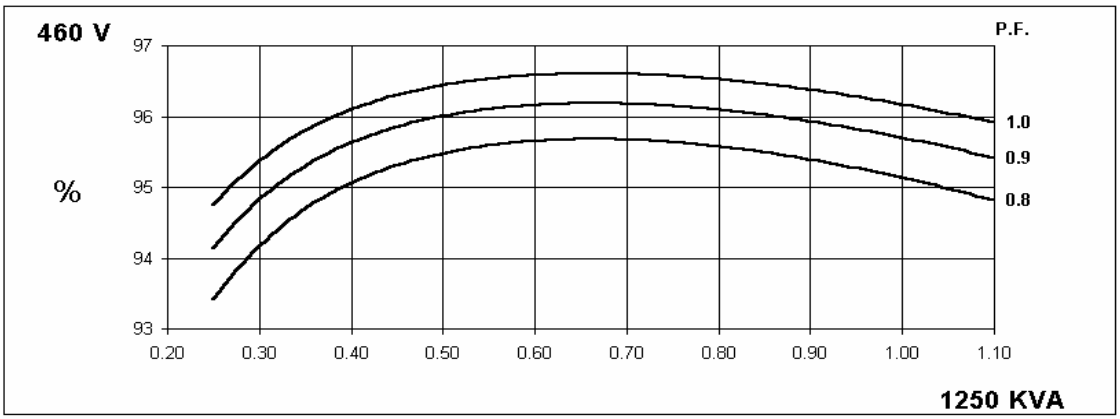
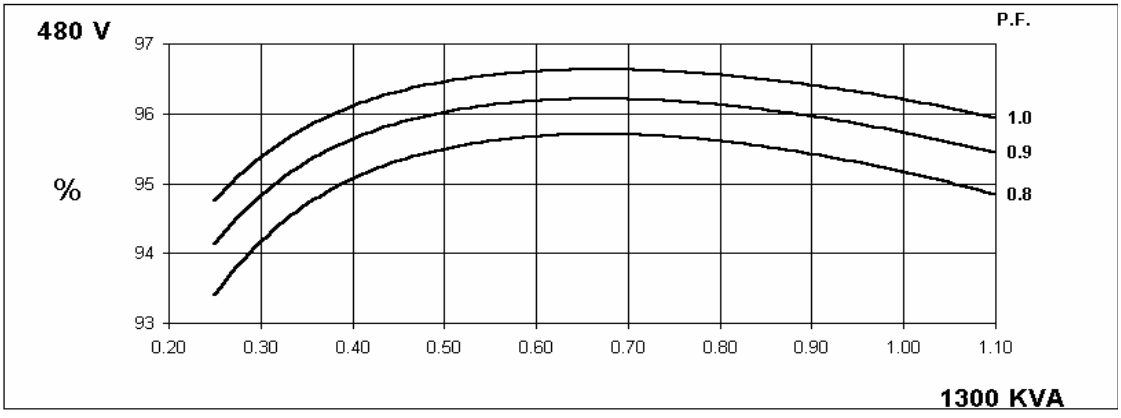
WINDING 311 and 312

THREE PHASE EFFICIENCY CURVES

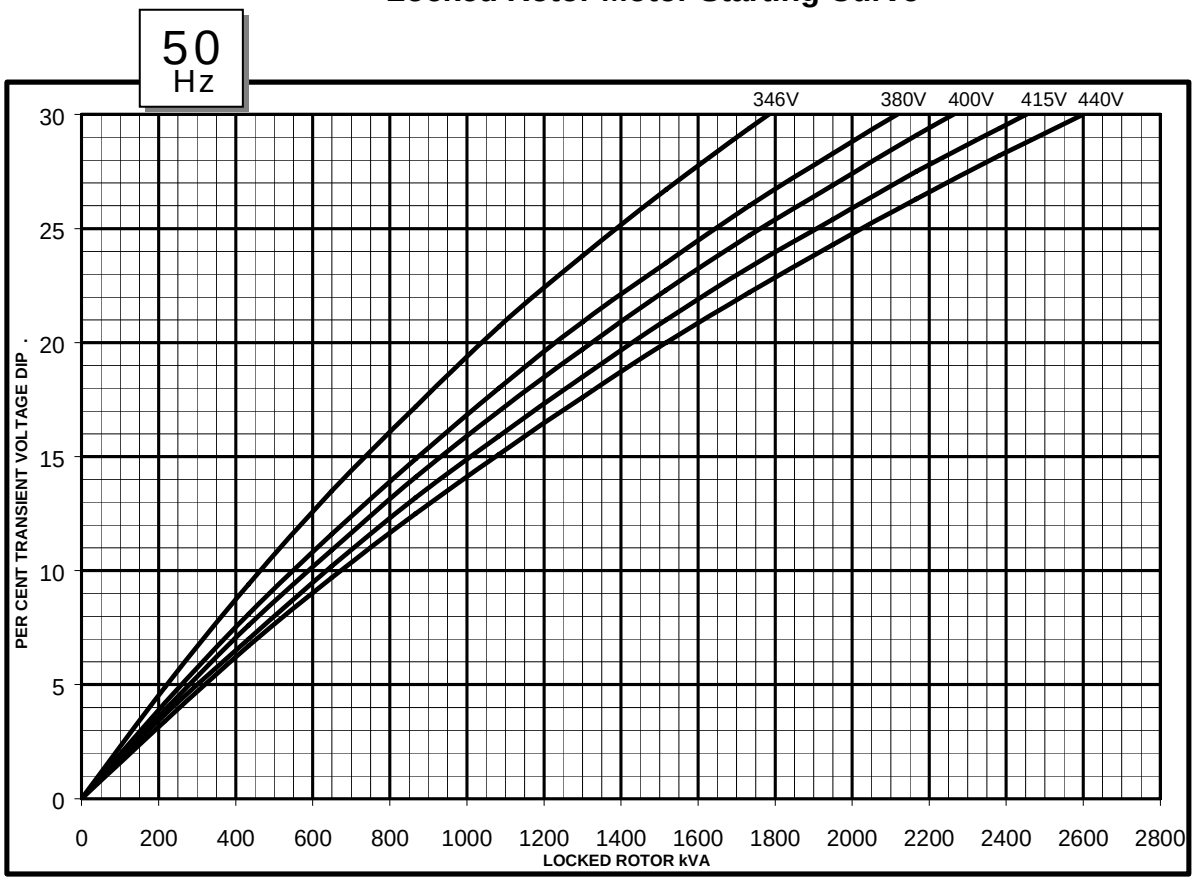


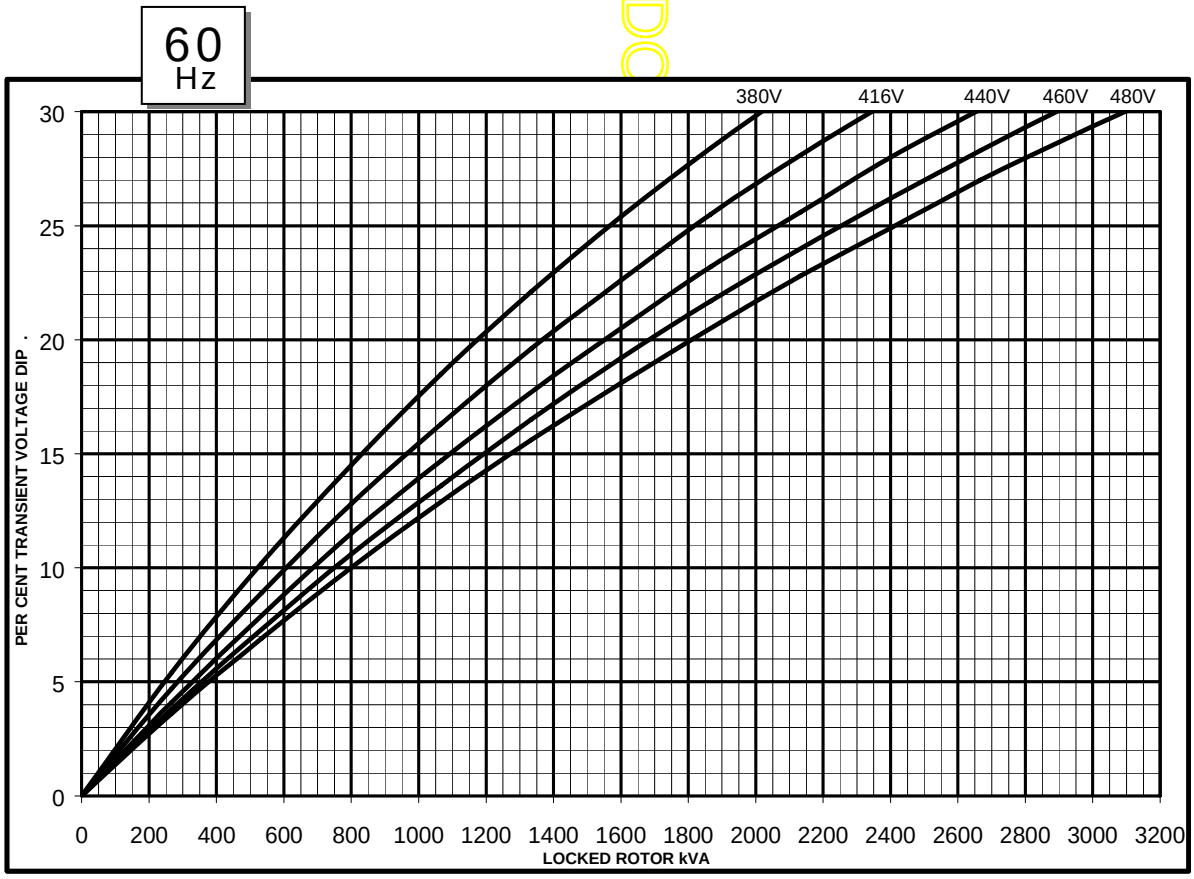






Locked Rotor Motor Starting Curve





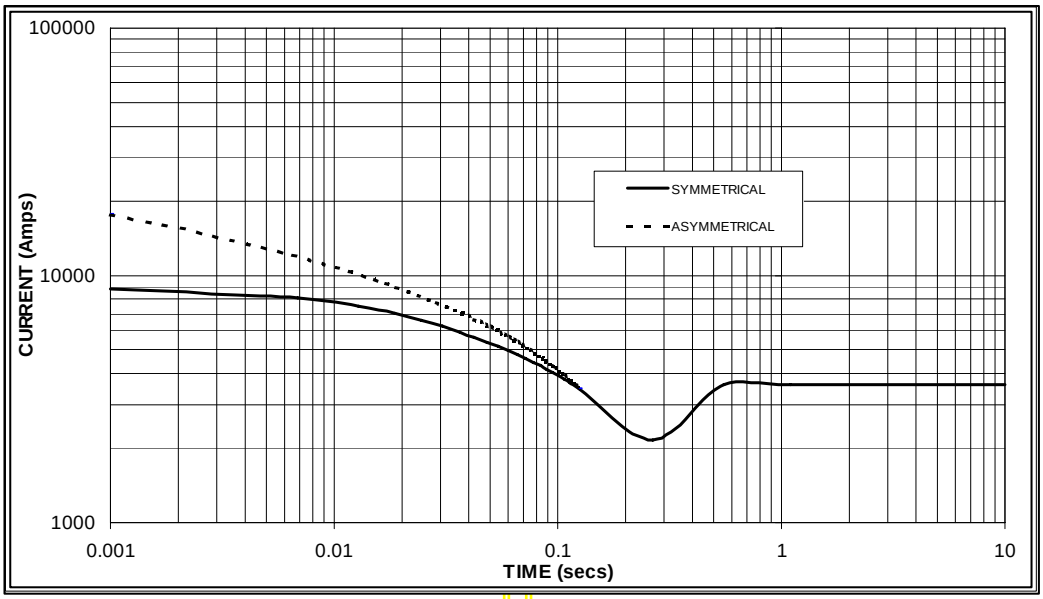
HCI634J

WINDING 311 and 312

Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed

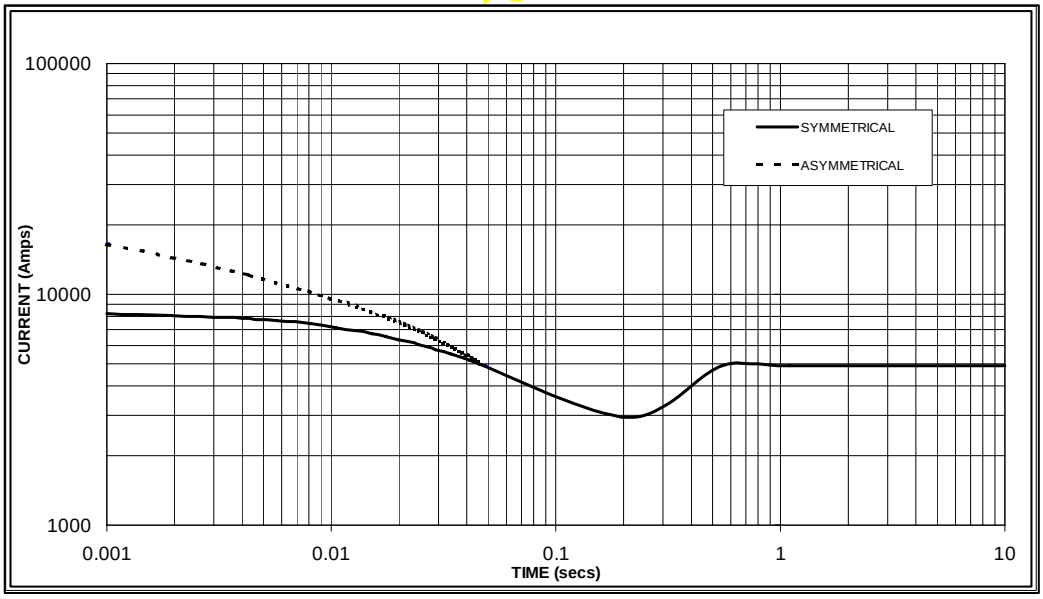
Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 3,600 Amps

60 Hz



Sustained Short Circuit = 4,900 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

HCI634J

Winding 311 and 312 0.8 Power Factor

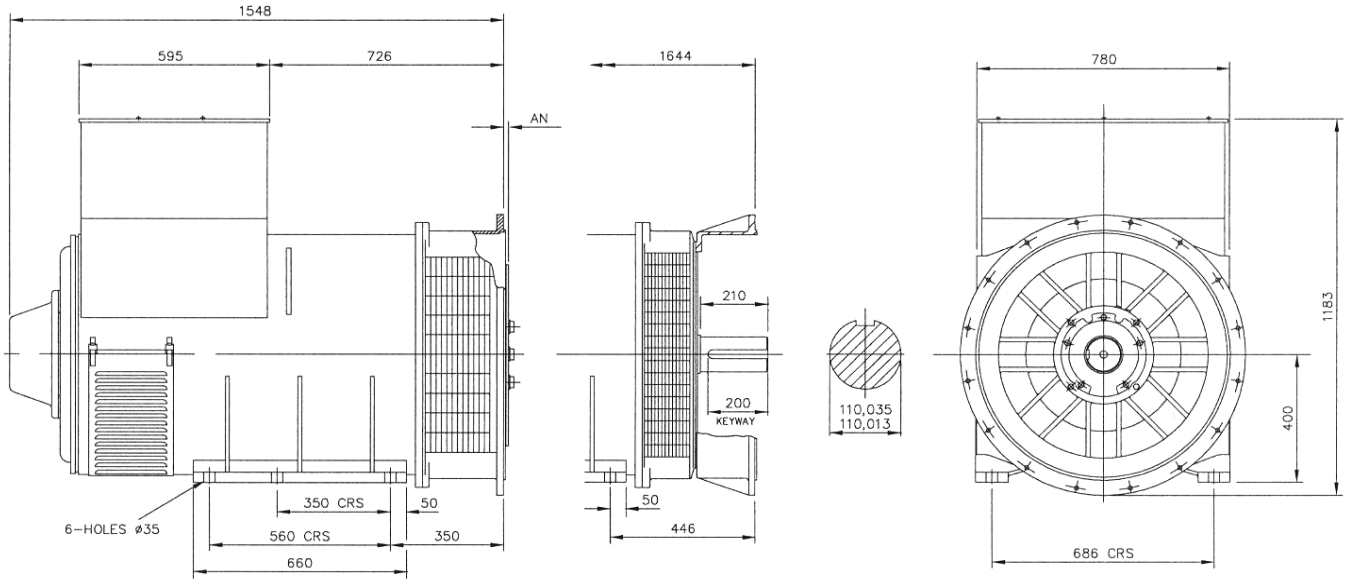
RATINGS

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	900	927	927	900	1000	1030	1030	1010	1060	1070	1070	1060	1100	1110	1110	1100
kW	720	742	742	720	800	824	824	808	848	856	856	848	880	888	888	880
Efficiency (%)	95.3	95.4	95.5	95.6	95.0	95.1	95.2	95.4	94.7	94.9	95.1	95.3	94.6	94.8	94.9	95.2
kW Input	756	777	777	753	842	866	866	847	895	902	900	890	930	937	936	924

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	1063	1100	1150	1188	1150	1200	1250	1300	1206	1250	1300	1350	1250	1300	1350	1400
kW	850	880	920	950	920	960	1000	1040	965	1000	1040	1080	1000	1040	1080	1120
Efficiency (%)	95.2	95.3	95.3	95.4	95.0	95.1	95.1	95.2	94.8	95.0	95.0	95.1	94.7	94.8	94.9	94.9
kW Input	893	923	965	996	968	1009	1052	1092	1018	1053	1095	1136	1056	1097	1138	1180

* Parallel Star only available with Wdg 311

DIMENSIONS



SAE	14	18	21	24
AN	25.4	15.87	0	0

APPROVED DOCUMENT

STAMFORD

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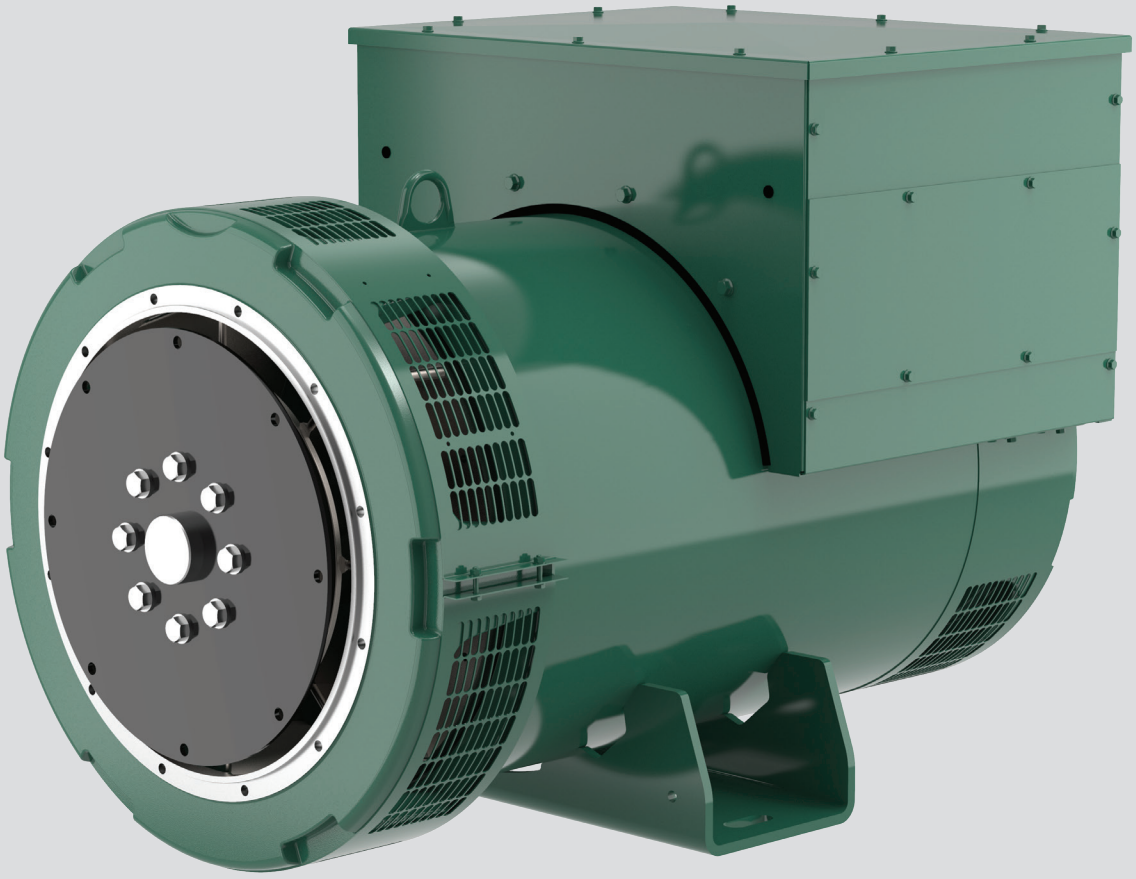


LSA 47.2

Low Voltage Alternator - 4 pole

365 to 600 kVA - 50 Hz / 456 to 750 kVA - 60 Hz
Electrical and mechanical data

LEROY-SOMER™

Nidec
All for dreams

The best of performance

Nidec Leroy-Somer LSA 47.2 alternator has been designed to offer you the best power generation performances. With its meticulous design and optimized architecture, the LSA 47.2 strikes the perfect balance between compactness, reliability, performance and longevity.
Whatever your application, the LSA 47.2 will meet your needs and will adapt to all situations.

Standards

Nidec Leroy-Somer LSA 47.2 alternator meets all key international standards and regulations, including IEC 60034, NEMA MG 1.32-33, ISO 8528-3, CSA C22.2 n°100-14 and UL 1446 (UL 1004 on request). Also compliant with IEC 61000-6-2, IEC 61000-6-3, IEC 61000-6-4, VDE 0875G, VDE 0875N and EN 55011, group 1 class A for European zone.
Nidec Leroy-Somer LSA 47.2 alternator can be integrated in EC marked generator set, and bears EC, EAC and CMIM markings. It is designed, manufactured and marketed in an ISO 9001 and ISO 14001 quality assurance environment.

Electrical characteristics and performances

- Class H insulation
- 2/3 pitch winding, standard 12-wire (6) reconnectable (the LSA 47.2 L9 is available in two versions: 6-wire and 12-wire)
- Voltage range:
  - 50 Hz: 220V - 240V and 380V - 415V (440V)
  - 60 Hz: 208V - 240V and 380V - 480V
- High efficiency and motor starting capacity
- Other voltages are possible with optional adapted windings:
  - 50 Hz: 440V (no. 7), 500V (no. 9), 550V (no. 22 or 23), 600V (no. 23), 690V (no. 52)
  - 60 Hz: 380V and 416V (no. 8), 600V (no. 9), 690V (no. 22 or 23)

Excitation and regulation system

Excitation system				Regulation options		
AVR	**SHUNT**	**AREP** (option)	**PMG** (option)	**C.T. Current transformer for paralleling**	**Mains paralleling**	**Remote voltage potentiometer**
R250	Standard					√
D350		Standard	Standard	√		√
D550	Option	Option	Option	√	√	√

3-phase sensing is included as a standard with digital regulators.

Protection system and options

- The LSA 47.2 is IP 23
- Complete winding protection for clean environments with relative humidity ≤ 95 %, including indoor marine environments
- Options:
  - Filters on air inlet: derating 5%
  - Filters on air inlet and air outlet (IP 44): derating 10%
  - Reinforced winding protections for harsh environments and relative humidity greater than 95%
  - Space heater
  - Thermal protection for stator windings and shields

Mechanical construction

- Compact and rigid assembly to better withstand generator vibrations
- Steel frame
- Cast iron flanges and shields
- Two-bearing and single-bearing versions designed to be suitable for engines on the market
- Half-key balancing
- Greased for life bearings, regreasable bearings (optional)
- Standard direction of rotation: clockwise when looking at the drive end view (for anti-clockwise, derate the machine by 5%)

Terminal box design

- Easy access to the voltage regulator and to the connections
- Possible inclusion of accessories for paralleling, protection and measurement
- 9-way terminal block for voltage reconnection

General characteristics

Insulation class	H
Winding pitch	2/3 (wind.6 - 12-wire / wind.6S - 6-wire)
Number of wires	12 / 6
Protection	IP 23
Altitude	≤ 1000 m
Overspeed	2250 R.P.M.
Air flow	0.9 m^3/s (50 Hz) / 1.1 m^3/s (60 Hz)

Excitation system	SHUNT (12 wire)	AREP / PMG
AVR type	R250	D350
Voltage regulation (*)	± 0.5%	± 0.25%
Short-circuit current	-	300% (3 IN) : 10s
Total Harmonic distortion THD (**)	no load < 1.5% - on load < 2%	
Waveform: NEMA = TIF (**)	< 50	

(*) Steady state (**) Total harmonic distortion between phases, no-load or on-load (non-distorting)

Ratings 50 Hz - 1500 R.P.M.

kVA / kW - P.F. = 0.8

Duty/T°C		Continuous duty/40°C			Continuous duty/40°C			Stand-by/40°C			Stand-by/27°C		
Class/T°K		H/125°K			F/105°K			H/150°K			H/163°K		
Phase		3 ph.			3 ph.			3 ph.			3 ph.		
Y		380V	**400V**	415V	380V	**400V**	415V	380V	**400V**	415V	380V	**400V**	415V
Δ		220V	**230V**	240V	220V	**230V**	240V	220V	**230V**	240V	220V	**230V**	240V
YY			**200V**			**200V**			**200V**			**200V**	
12 wires version													
LSA 47.2 VS2	kVA	365	**365**	365	330	**330**	330	405	**405**	405	420	**420**	420
	kW	*292*	***292***	*292*	*264*	*264*	*264*	*324*	***324***	*324*	*336*	***336***	*336*
LSA 47.2 S4	kVA	410	**410**	410	370	**370**	370	430	**430**	430	450	**450**	450
	kW	*328*	***328***	*328*	*296*	*296*	*296*	*344*	***344***	*344*	*360*	***360***	*360*
LSA 47.2 S5	kVA	455	**455**	455	405	**405**	405	471	**471**	471	500	**500**	500
	kW	*364*	***364***	*364*	*324*	*324*	*324*	*377*	***377***	*377*	*400*	***400***	*400*
LSA 47.2 M7	kVA	500	**500**	500	465	**465**	465	550	**550**	550	570	**570**	570
	kW	*400*	***400***	*400*	*372*	*372*	*372*	*440*	***440***	*440*	*456*	***456***	*456*
LSA 47.2 M8	kVA	550	**550**	550	500	**500**	500	575	**575**	575	600	**600**	600
	kW	*440*	***440***	*440*	*400*	*400*	*400*	*460*	***460***	*460*	*480*	***480***	*480*
LSA 47.2 L9	kVA	600	**600**	600	535	**535**	535	630	**630**	630	660	**660**	660
	kW	*480*	***480***	*480*	*428*	*428*	*428*	*504*	***504***	*504*	*528*	***528***	*528*
6 wires version													
Y		380V	**400V**	415V	380V	**400V**	415V	380V	**400V**	415V	380V	**400V**	415V
Δ		220V	**230V**	240V	220V	**230V**	240V	220V	**230V**	240V	220V	**230V**	240V
LSA 47.2 L9*	kVA	600	**600**	600	535	**535**	535	630	**630**	630	660	**660**	660
	kW	*480*	***480***	*480*	*428*	***428***	*428*	*504*	***504***	*504*	*528*	***528***	*528*

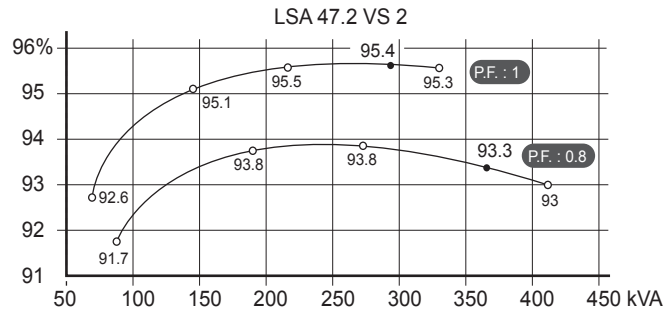
Ratings 60 Hz - 1800 R.P.M.

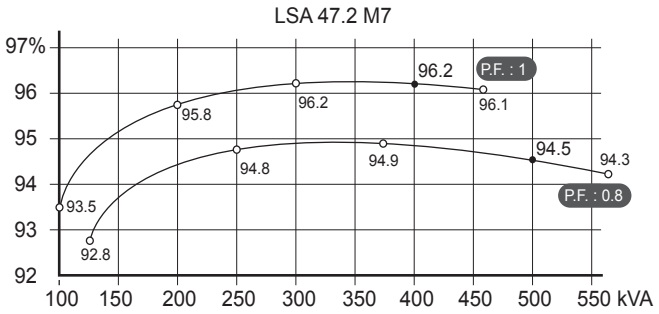
kVA / kW - P.F. = 0.8

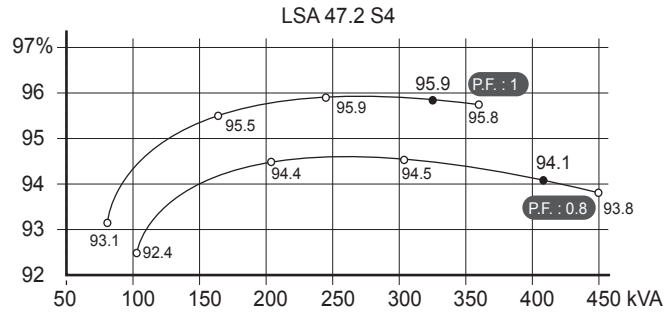
Duty/T°C		Continuous duty/40°C				Continuous duty/40°C				Stand-by/40°C				Stand-by/27°C			
Class/T°K		H/125°K				F/105°K				H/150°K				H/163°K			
Phase		3 ph.				3 ph.				3 ph.				3 ph.			
Y		380V	416V	440V	**480V**	380V	416V	440V	**480V**	380V	416V	440V	**480V**	380V	416V	440V	**480V**
Δ		220V	240V			220V	240V			220V	240V			220V	240V		
YY			208V	220V	**240V**		208V	220V	**240V**		208V	220V	**240V**		208V	220V	**240V**
12 wires version																	
LSA 47.2 VS2	kVA	424	454	456	**456**	394	410	410	**410**	451	483	500	**511**	469	500	518	**530**
	kW	*339*	*363*	*365*	***365***	*315*	*328*	*328*	***328***	*361*	*386*	*400*	***409***	*375*	*400*	*414*	***424***
LSA 47.2 S4	kVA	450	480	500	**512**	396	442	442	**465**	475	513	533	**550**	500	530	550	**581**
	kW	*360*	*384*	*400*	***410***	*317*	*354*	*354*	***372***	*380*	*410*	*426*	***440***	*400*	*424*	*440*	***465***
LSA 47.2 S5	kVA	475	510	531	**570**	441	473	493	**518**	503	543	566	**592**	527	562	585	**625**
	kW	*380*	*408*	*425*	***456***	*353*	*378*	*394*	***414***	*402*	*434*	*453*	***474***	*422*	*450*	*468*	***500***
LSA 47.2 M7	kVA	562	610	625	**625**	523	566	581	**590**	600	651	669	**680**	625	668	690	**700**
	kW	*450*	*488*	*500*	***500***	*418*	*453*	*465*	***472***	*480*	*521*	*535*	***554***	*500*	*534*	*552*	***560***
LSA 47.2 M8	kVA	562	610	630	**690**	523	566	587	**632**	600	651	672	**729**	625	671	705	**750**
	kW	*450*	*488*	*504*	***552***	*418*	*453*	*470*	***506***	*480*	*521*	*538*	***583***	*500*	*537*	*564*	***600***
LSA 47.2 L9	kVA	602	661	685	**750**	556	609	634	**675**	643	707	734	**780**	667	728	763	**825**
	kW	*482*	*529*	*548*	***600***	*445*	*487*	*507*	***540***	*514*	*566*	*587*	***624***	*534*	*582*	*610*	***660***
6 wires version																	
Y		380V	416V	440V	**480V**	380V	416V	440V	**480V**	380V	416V	440V	**480V**	380V	416V	440V	**480V**
Δ		220V	240V			220V	240V			220V	240V			220V	240V		
LSA 47.2 L9*	kVA	602	661	685	**750**	556	609	634	**675**	643	707	734	**780**	667	728	763	**825**
	kW	*482*	*529*	*548*	***600***	*445*	*487*	*507*	***540***	*514*	*566*	*587*	***624***	*534*	*582*	*610*	***660***

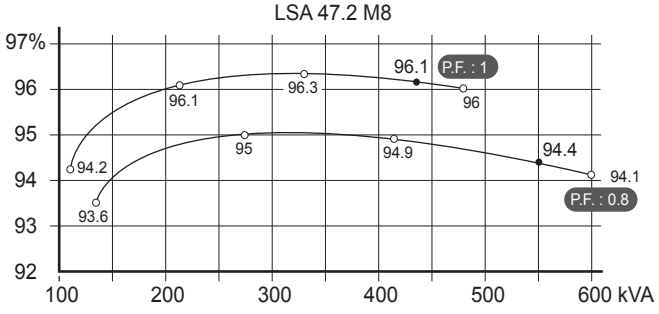
** AREP excitation only*

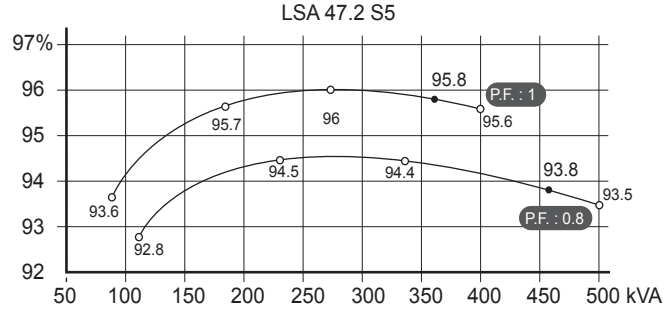
Efficiencies 400 V - 50 Hz (P.F.: 1) (P.F.: 0.8)

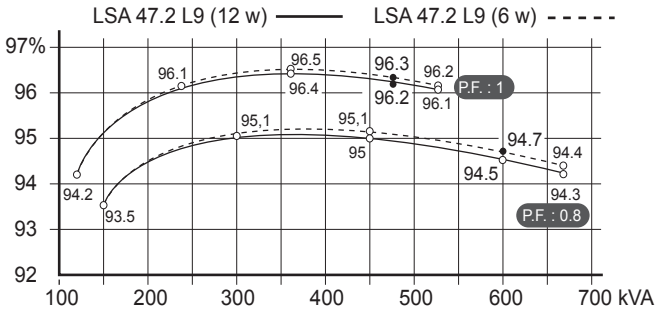










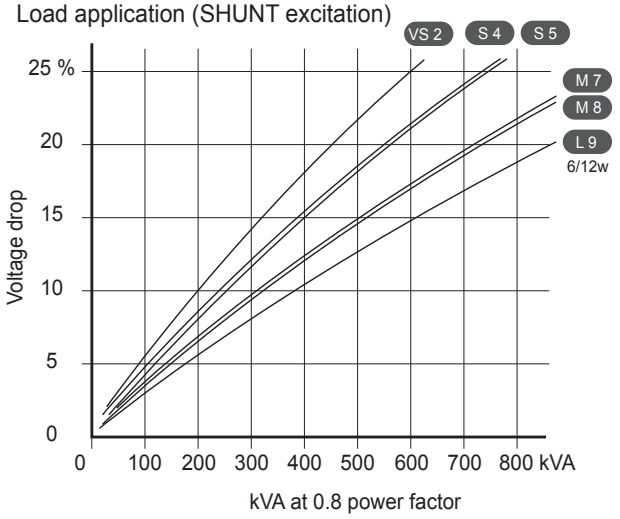


Reactances (%). Time constants (ms) - Class H / 400 V

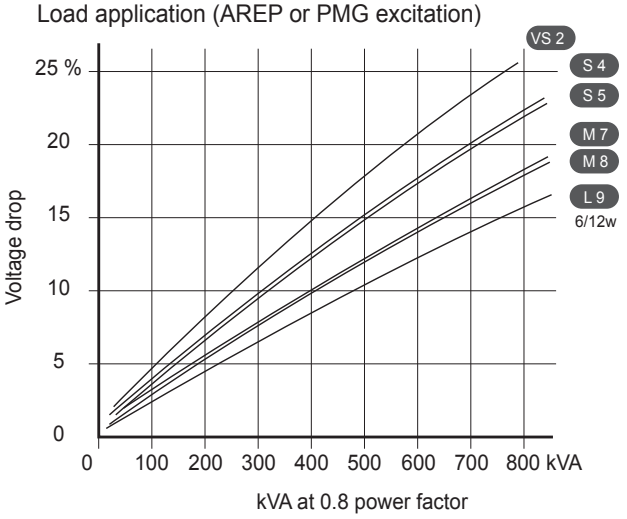
		VS2 (12w)	S4 (12w)	S5 (12w)	M7 (12w)	M8 (12w)	L9 (12w)	L9 (6w)
Kcc	Short-circuit ratio	0.38	0.37	0.33	0.41	0.32	0.37	0.38
Xd	Direct-axis synchronous reactance unsaturated	336	322	357	307	360	330	325
Xq	Quadrature-axis synchronous reactance unsaturated	201	193	214	184	216	198	195
T'do	No-load transient time constant	1738	1855	1855	1930	1958	1997	1997
X'd	Direct-axis transient reactance saturated	19.3	17.3	19.2	15.9	18.3	16.5	16.2
T'd	Short-circuit transient time constant	100	100	100	100	100	100	100
X"d	Direct-axis subtransient reactance saturated	13.5	12.1	13.5	11.1	12.9	11.4	11.6
T"d	Subtransient time constant	10	10	10	10	10	10	10
X"q	Quadrature-axis subtransient reactance saturated	18.4	16.3	18	14.7	17	15	15.2
Xo	Zero sequence reactance	0.9	0.9	0.9	0.7	0.6	0.9	0.2
X2	Negative sequence reactance saturated	16	14.2	15.8	13	15	13.2	13.4
Ta	Armature time constant	15	15	15	15	15	15	15
Other class H/400 V data								
io (A)	No-load excitation current	1	0.9	0.9	1	0.9	0.9	0.9
ic (A)	On-load excitation current	3.8	3.5	3.8	3.6	3.7	3.7	3.7
uc (V)	On-load excitation voltage	39	35	38	36	37	36	36
ms	Response time (ΔU = 20% transient)	500	500	500	500	500	500	500
kVA	Start (ΔU = 20% cont. or 30% trans.) SHUNT	722	928	928	1073	1159	1258	1258
kVA	Start (ΔU = 20% cont. or 30% trans.) AREP	805	1035	1035	1195	1294	1400	1400
%	Transient ΔU (on-load 4/4) SHUNT - P.F.: 0.8 $_{LAG}$	16.8	15.5	16.7	14.6	16.2	15	14.8
%	Transient ΔU (on-load 4/4) AREP - P.F.: 0.8 $_{LAG}$	13.7	12.7	13.6	11.9	13.2	12.2	12.1
W	No-load losses	5440	5690	5690	6540	6120	6780	6880
W	Heat dissipation	20780	20470	23780	23040	26020	27490	26720

Transient voltage variation 400V - 50 Hz

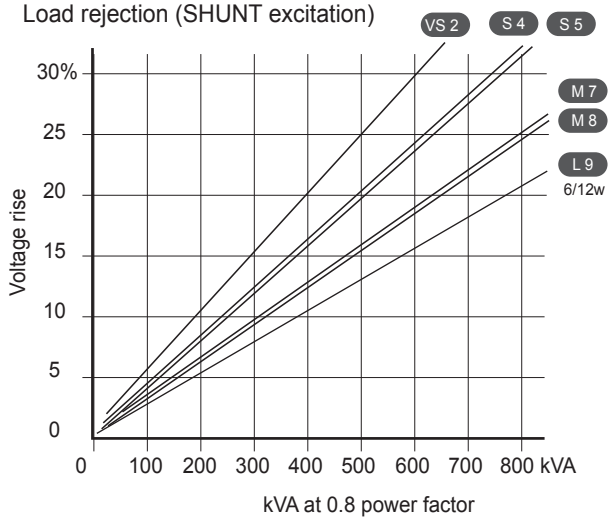
Load application (SHUNT excitation)



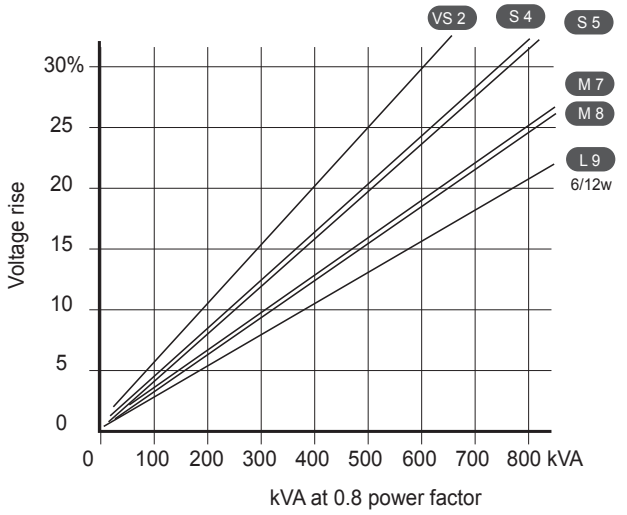
Load application (AREP or PMG excitation)



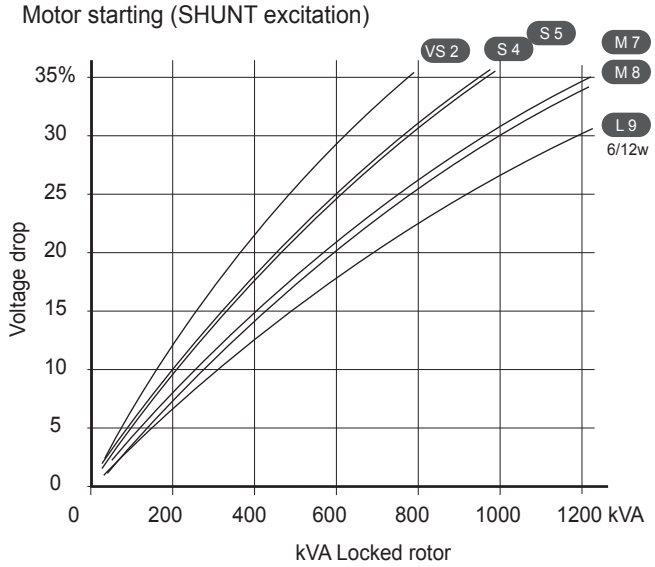
Load rejection (SHUNT excitation)



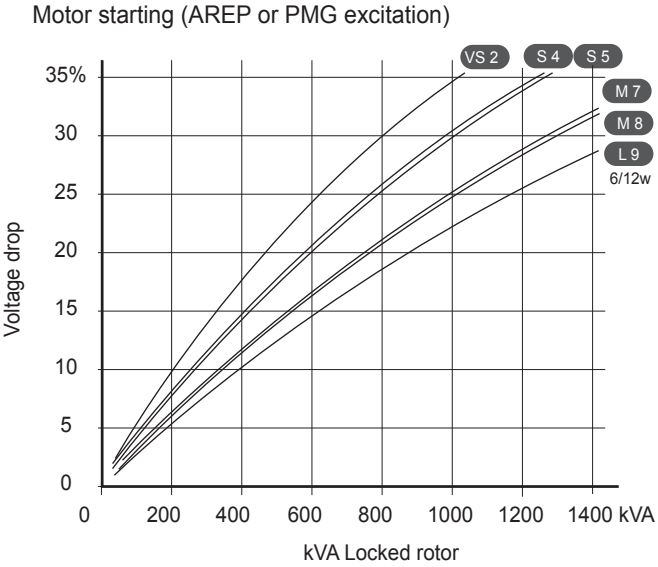
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



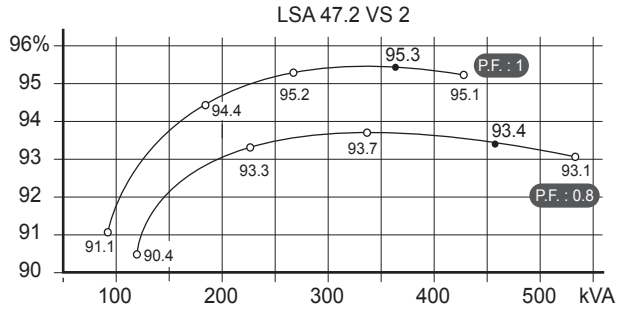
Motor starting (AREP or PMG excitation)

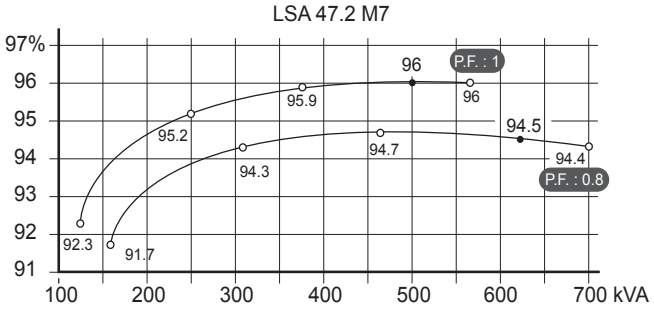


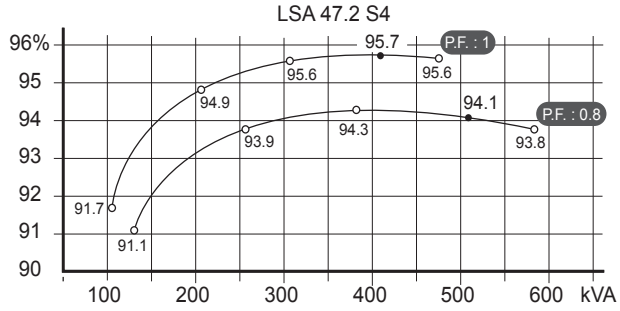
1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by K = Sine P.F. / 0.8

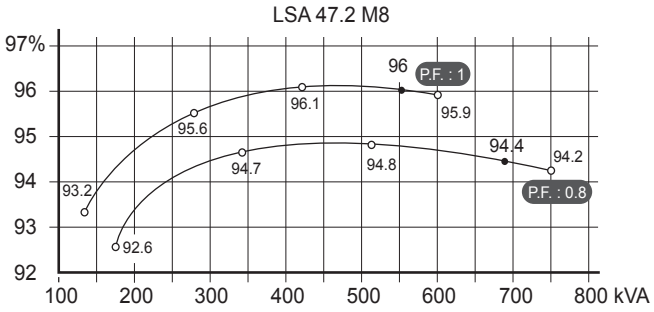
2) For voltages other than 400V (Y), 230V (Δ) at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

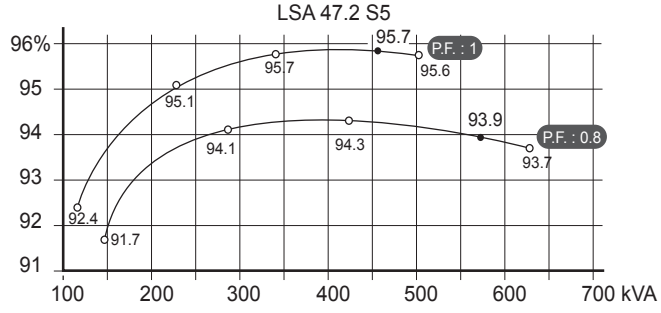
Efficiencies 480 V - 60 Hz (P.F.: 1) (P.F.: 0.8)

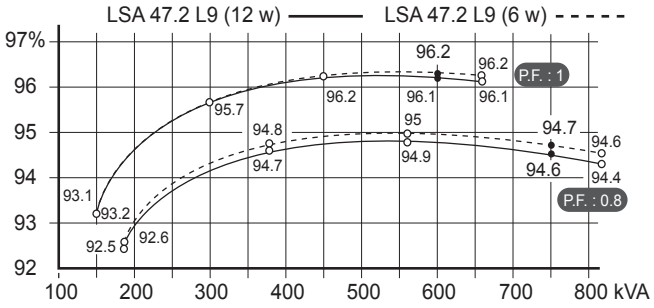










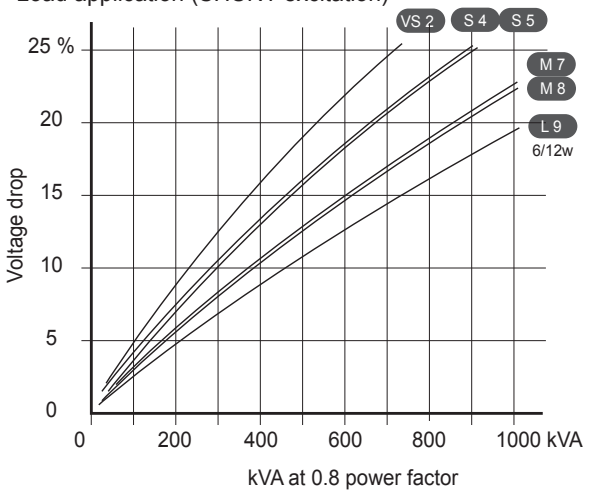


Reactances (%). Time constants (ms) - Class H / 480 V

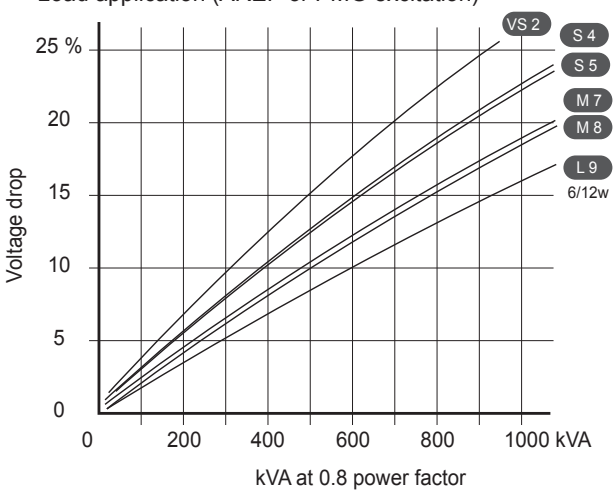
		VS2 (12w)	S4 (12w)	S5 (12w)	M7 (12w)	M8 (12w)	L9 (12w)	L9 (6w)
Kcc	Short-circuit ratio	0.36	0.36	0.32	0.40	0.31	0.35	0.36
Xd	Direct-axis synchronous reactance unsaturated	349	335	373	319	376	344	338
Xq	Quadrature-axis synchronous reactance unsaturated	209	201	223	191	225	206	203
T'do	No-load transient time constant	1738	1855	1855	1930	1958	1997	1997
X'd	Direct-axis transient reactance saturated	20.1	18	20.1	16.5	19.2	17.2	16.9
T'd	Short-circuit transient time constant	100	100	100	100	100	100	100
X"d	Direct-axis subtransient reactance saturated	14.1	12.6	14	11.6	13.4	11.8	12.1
T"d	Subtransient time constant	10	10	10	10	10	10	10
X"q	Quadrature-axis subtransient reactance saturated	19.1	16.9	18.8	15.3	17.8	15.6	15.8
Xo	Zero sequence reactance	0.1	0.4	0.1	0.1	0.9	0.9	0.4
X2	Negative sequence reactance saturated	16.6	14.8	16.5	13.5	15.6	13.7	14
Ta	Armature time constant	15	15	15	15	15	15	15
Other class H/480 V data								
io (A)	No-load excitation current	1	0.9	0.9	1	0.9	0.9	0.9
ic (A)	On-load excitation current	3.9	3.5	3.9	3.7	3.8	3.7	3.7
uc (V)	On-load excitation voltage	40	35	39	37	38	37	37
ms	Response time (ΔU = 20% transient)	500	500	500	500	500	500	500
kVA	Start (ΔU = 20% cont. or 30% trans.) SHUNT	890	1136	1136	1318	1433	1550	1554
kVA	Start (ΔU = 20% cont. or 30% trans.) AREP	994	1271	1271	1473	1606	1733	1737
%	Transient ΔU (on-load 4/4) SHUNT - P.F.: 0.8 $_{LAG}$	17.3	16	17.3	15	16.7	15.5	15.3
%	Transient ΔU (on-load 4/4) AREP - P.F.: 0.8 $_{LAG}$	14.1	13	14.1	12.2	13.6	12.6	12.4
W	No-load losses	8540	8910	8910	10080	9530	10440	10580
W	Heat dissipation	25650	25650	29340	28630	32190	33870	33010

Transient voltage variation 480V - 60 Hz

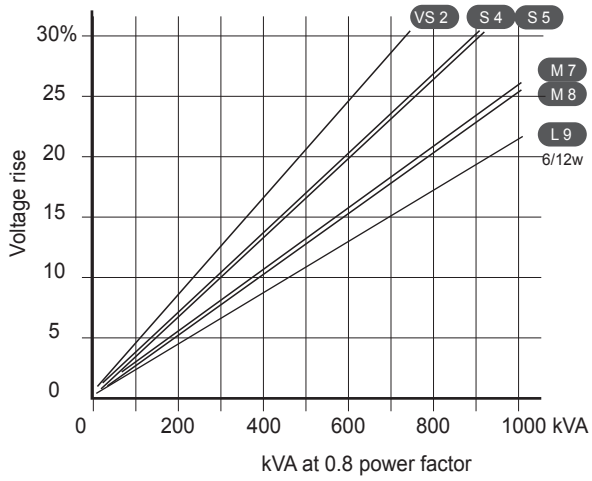
Load application (SHUNT excitation)



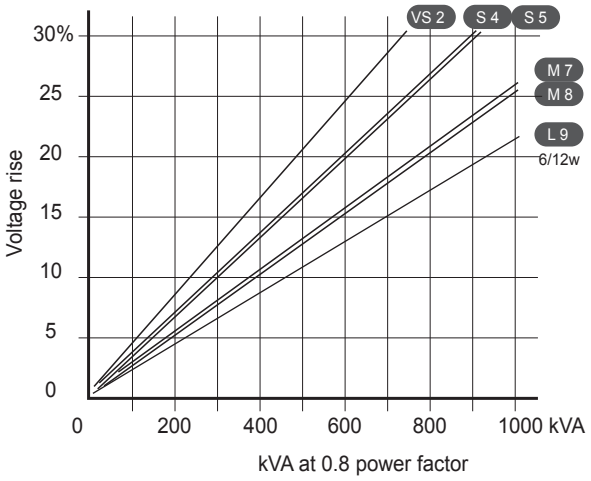
Load application (AREP or PMG excitation)



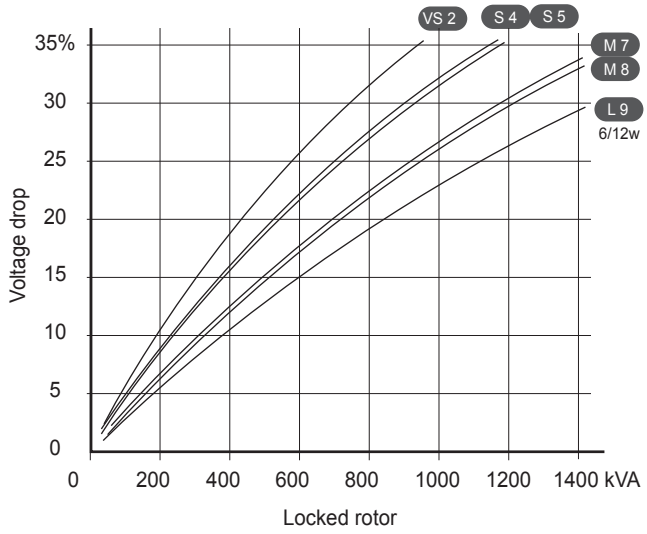
Load rejection (SHUNT excitation)



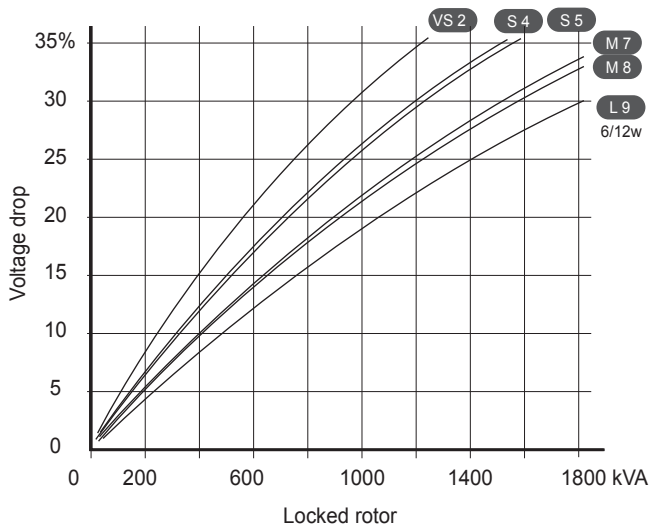
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



Motor starting (AREP or PMG excitation)

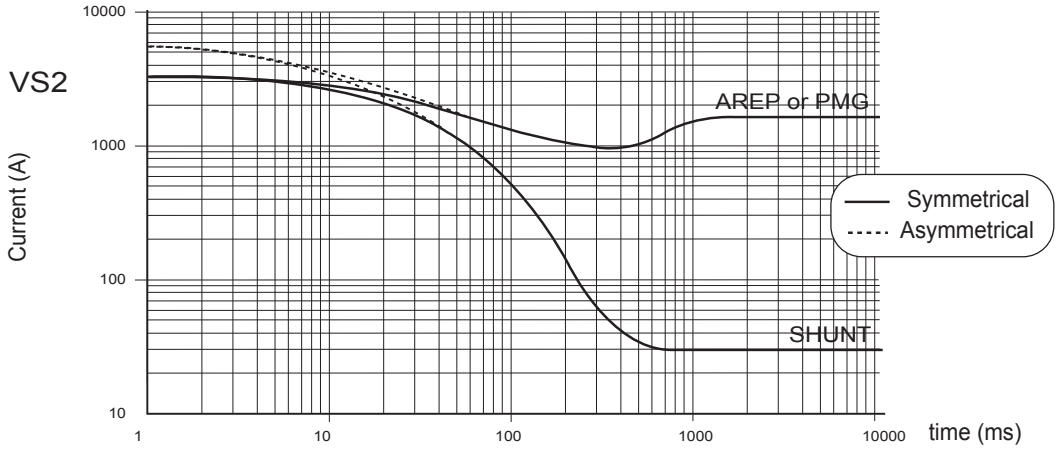


1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by K = Sine P.F. / 0.8

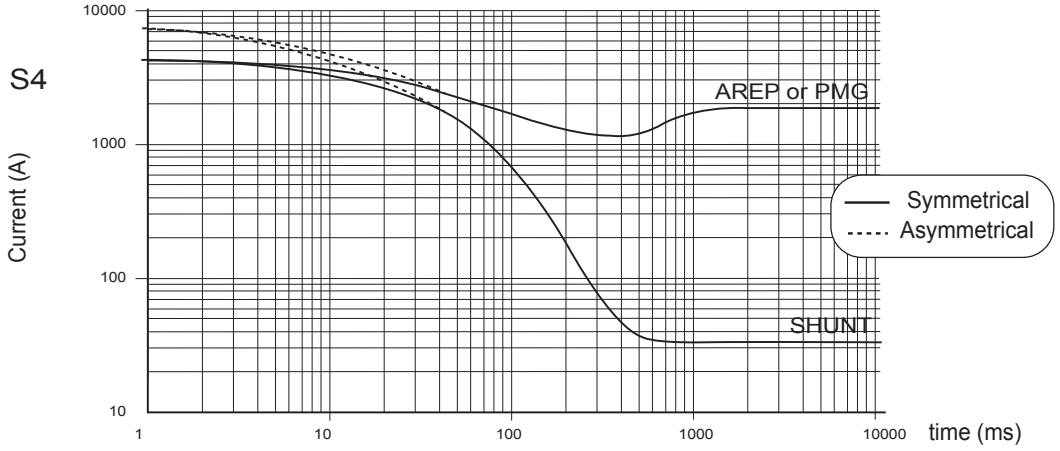
2) For voltages other than 480V (Y), 277V (Δ), 240V (YY) at 60 Hz, then kVA must be multiplied by $(480/U)^2$ or $(277/U)^2$ or $(240/U)^2$.

3-phase short-circuit curves at no load and rated speed (star connection Y)

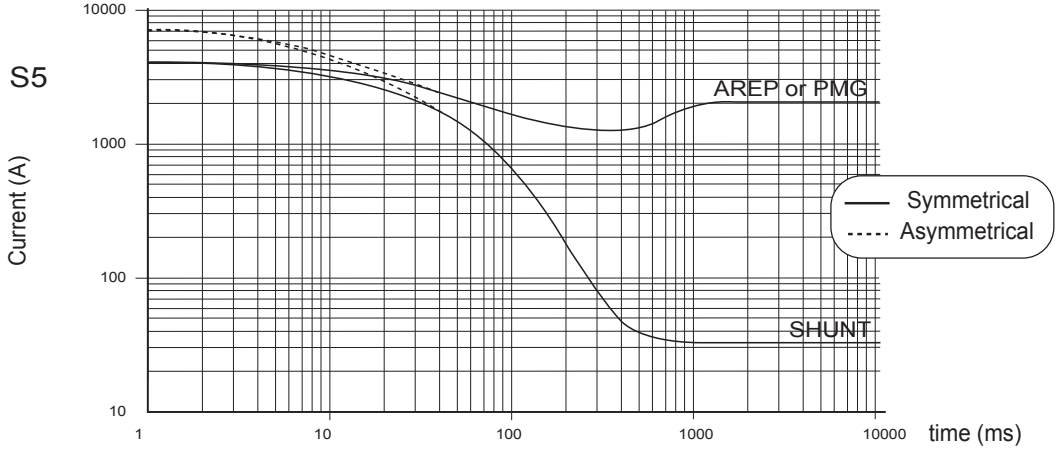
LSA 47.2 VS2



LSA 47.2 S4



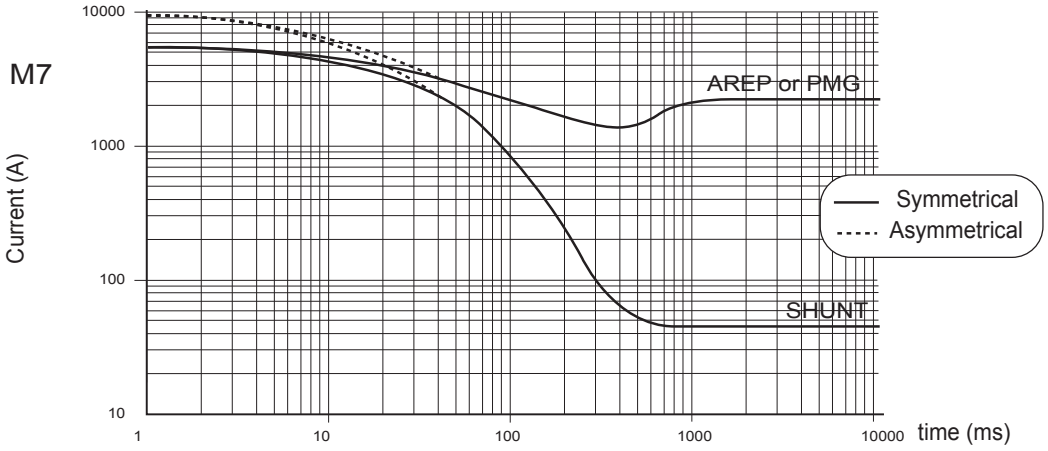
LSA 47.2 S5



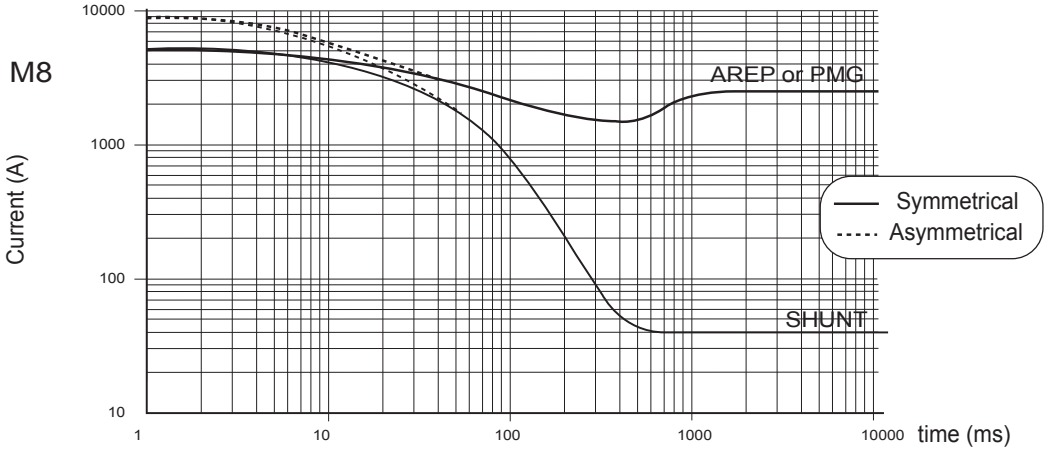
Influence due to connection
Curves shown are for star (Y) connection.
For other connections, use the following multiplication factors:
- Series delta : current value x 1.732 - Parallel star : current value x 2

3-phase short-circuit curves at no load and rated speed (star connection Y)

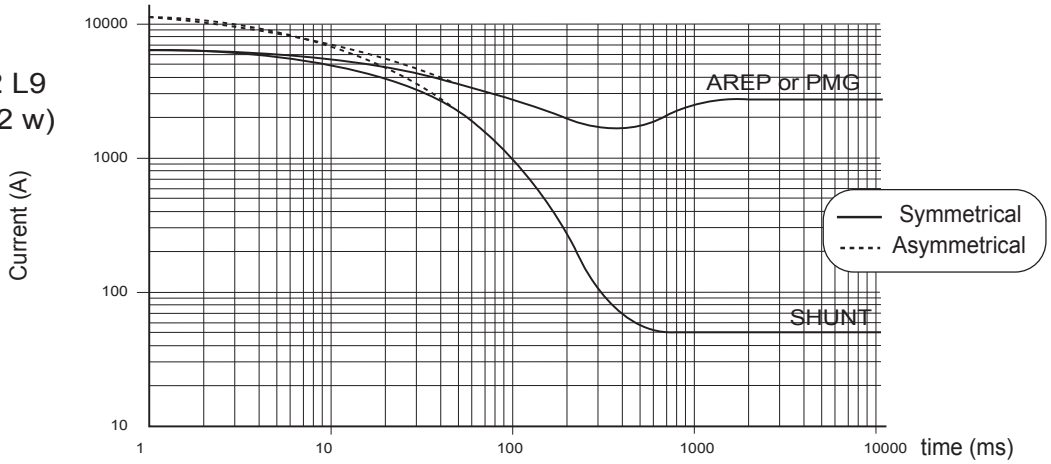
LSA 47.2 M7



LSA 47.2 M8



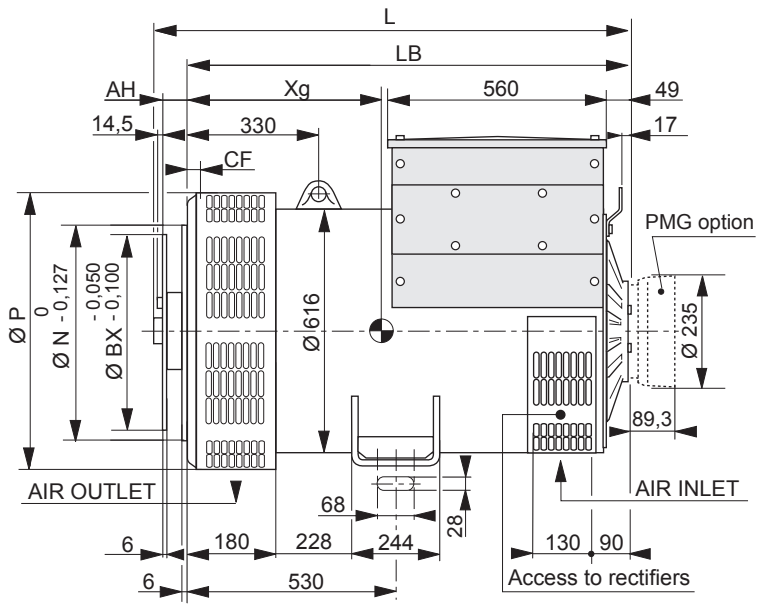
LSA 47.2 L9
(6w / 12 w)

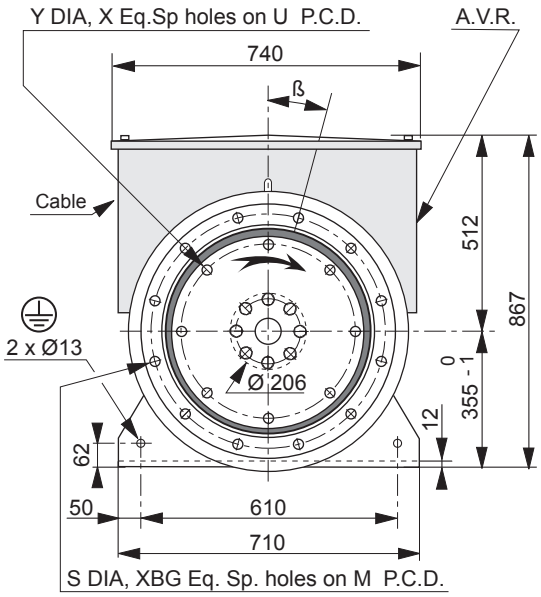


Influence due to short-circuit
Curves are based on a three-phase short-circuit.
For other types of short-circuit, use the following multiplication factors.

	3-phase	2-phase L/L	1-phase L/N
Instantaneous (max.)	1	0.87	1.3
Continuous	1	1.5	2.2
Maximum duration (AREP/PMG)	10 sec.	5 sec.	2 sec.

Single-bearing dimensions





Dimensions (mm) and weight				
Type	L without PMG maxi*	LB	Xg	Weight (kg)
LSA 47.2 VS2	1055	996	437	976
LSA 47.2 S4	1115	1056	471	1113
LSA 47.2 S5	1115	1056	471	1113
LSA 47.2 M7	1215	1156	511	1240
LSA 47.2 M8	1215	1156	520	1289
LSA 47.2 L9	1235	1176	545	1372

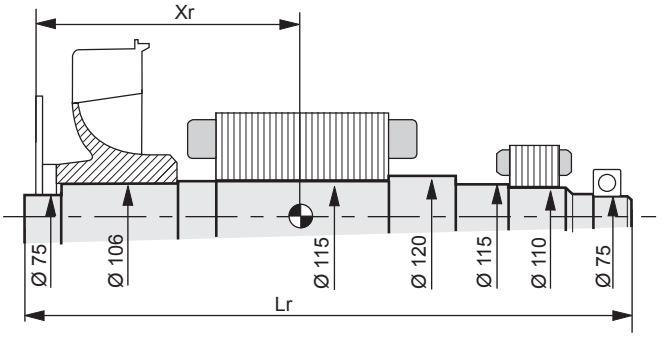
* L maxi = LB + AH maxi + 19

Coupling			
Flex plate	**11 ½**	**14**	**18**
Flange S.A.E 1	X	X	
Flange S.A.E ½		X	
Flange S.A.E 0		X	X

Flange (mm)							
S.A.E.	P	N	M	XBG	S	β°	CF
1	713	511.175	530.225	12	12	15°	15
½	713	584.2	619.125	12	14	15°	22
0	713	647.7	679.45	16	14	11° 15'	42

Flex plate (mm)					
S.A.E.	BX	U	X	Y	AH
11 ½	352.42	333.38	8	11	39.6
14	466.72	438.15	8	14	25.4
18	571.5	542.92	6	17	15.7

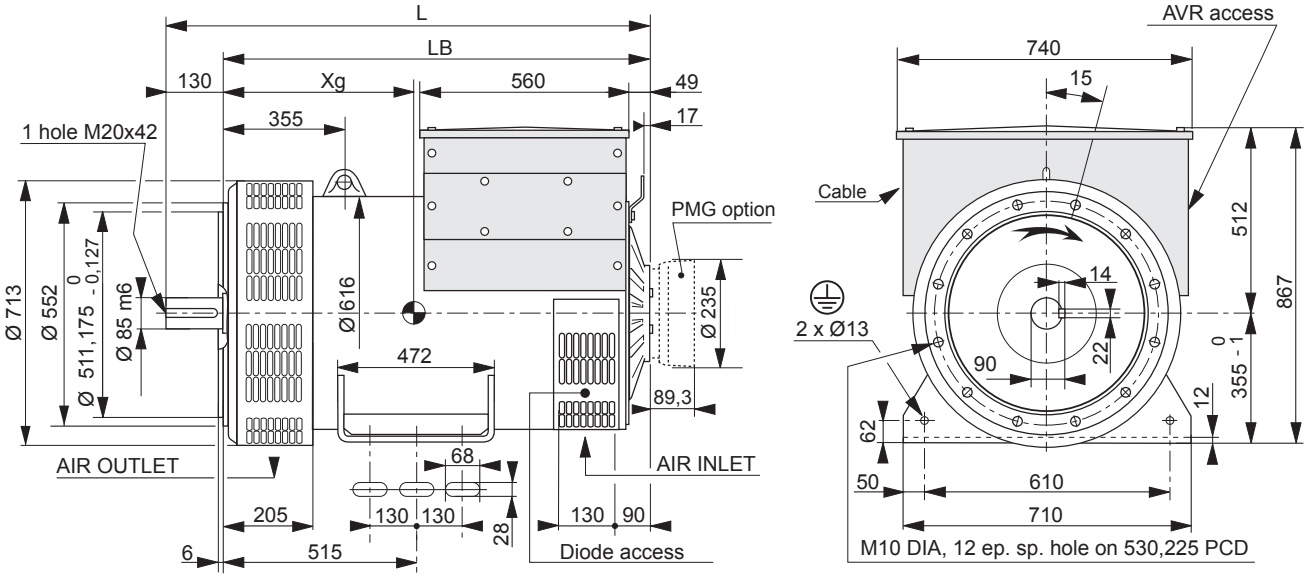
Torsional analysis data



Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm²): (4J = MD²)												
Flex plate	S.A.E. 11 ½				S.A.E. 14				S.A.E. 18			
Type	Xr	Lr	M	J	Xr	Lr	M	J	Xr	Lr	M	J
LSA 47.2 VS2	432.5	1029	387	5.99	418.3	1029	387	6.12	408.5	1029	387	6.38
LSA 47.2 S4	470	1089	442	6.90	456	1089	442	7.03	446	1089	442	7.29
LSA 47.2 S5	470	1089	442	6.90	456	1089	442	7.03	446	1089	442	7.29
LSA 47.2 M7	510	1189	495	7.61	496	1189	495	7.74	486	1189	495	8
LSA 47.2 M8	521	1189	514	8.01	507	1189	514	8.14	497	1189	514	8.40
LSA 47.2 L9	542	1209	547	8.52	528	1209	547	8.65	518	1209	547	8.91

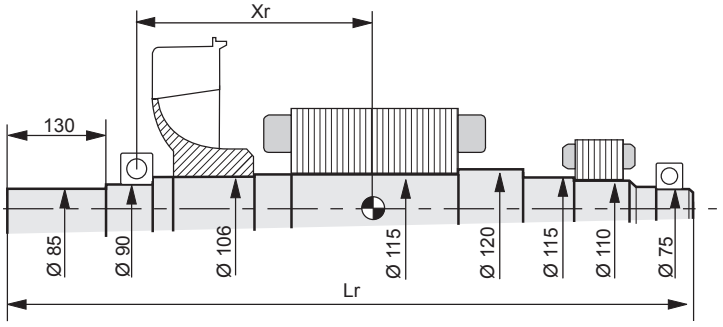
NOTE : Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.
The torsional analysis of the transmission is imperative. All values are available upon request.

Two-bearing dimensions



Dimensions (mm) and weight				
Type	L without PMG	LB	Xg	Weight (kg)
LSA 47.2 VS2	1151	1021	457	996
LSA 47.2 S4	1211	1081	491	1126
LSA 47.2 S5	1211	1081	491	1126
LSA 47.2 M7	1311	1181	531	1253
LSA 47.2 M8	1311	1181	531	1302
LSA 47.2 L9	1331	1201	565	1392

Torsional analysis data



Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm²): (4J = MD²)				
Type	Xr	Lr	M	J
LSA 47.2 VS2	396.4	1139	368.5	5.79
LSA 47.2 S4	433.2	1199	424	6.70
LSA 47.2 S5	433.2	1199	424	6.70
LSA 47.2 M7	473	1299	476.2	7.41
LSA 47.2 M8	483.5	1299	494.9	7.81
LSA 47.2 L9	504.5	1319	528	8.32

NOTE : Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.
The torsional analysis of the transmission is imperative. All values are available upon request.

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Attachment F: Wetlands and Watercourses Report

DAVISON ENVIRONMENTAL

Biodiversity Studies • Wetland Delineation & Assessment • Habitat Management • GIS Mapping • Permitting • Forestry

Wetland Delineation

April 27, 2021 **DE Project No.: 2020-27**

Prepared For: Eversource Energy
56 Prospect Street
Hartford, CT 06103
Attn: Mark Pappalardo

Eversource Project Name: 690 Line Rebuild Project

Project Location: Sharon & Salisbury, Connecticut

Date(s) of Investigations: February, March, and April, 2018 & March 2021

Field Conditions: Weather: variable
Soil Moisture: moist

Wetland/Watercourse Delineation Methodology[1]:
☒Connecticut Inland Wetlands and Watercourses
☐Connecticut Tidal Wetlands
☐Massachusetts Wetlands
☒U.S. Army Corps of Engineers

The wetlands inspection was performed by[2]:

Davison Environmental, LLC

Matthew Davison
Professional Soil Scientist
Professional Wetland Scientist

[1] Wetlands and watercourses were delineated in accordance with applicable local, state and federal statutes, regulations and guidance.
[2] Wetlands were delinetead by Davison Environmental Soil Scientists Eric and Matthew Davison. All established wetlands boundary lines are subject to change until officially adopted by local, state, or federal regulatory agencies.

Attachments

- Table 1: Delineated Wetlands and Watercourses within the 690 Line Rebuild Project Area
- Wetland Delineation Field Forms

Table 1: Delineated Wetlands and Watercourses within the 690 Line Rebuild Project Area

Aerial Map Sheet No.	Wetland No.[1]	Dominant NWI Class[2]	Other NWI Classes	Dominant Water Regime	Associated Watercourse[3]	Associated Potential Vernal Pool[4]
1	W1	PSS	PEM	Seasonally Flooded	---	---
1	W2	PSS	PFO	Seasonally Saturated-seepage	S2, S3, S4, S5 (Intermittent)	---
1	W3	PFO	---	Seasonally Saturated-seepage	S1 (Intermittent)	---
1	---	---	---	---	S6	---
1	---	---	---	---	S7	---
1	W4	PEM	PFO	Seasonally Saturated-seepage	S8 (Intermittent)	---
1	W5	PEM	---	Seasonally Saturated-seepage	---	---
2	W6	PFO	---	Seasonally Saturated-seepage	S9 (Intermittent)	---
2	W7	PSS	PEM	Seasonally Saturated-seepage	S10 (Unnamed Perennial)	---
2	W8	PFO	PEM	Seasonally Saturated-seepage	S11 (Unnamed Perennial)	---
2	W9	PEM	PSS	Seasonally Saturated-seepage	S12 (Unnamed Perennial)	VP1
3	W10	PSS	PEM	Permanently Saturated	S13 (Spring Brook)	---
3	W11	PSS	PEM	Seasonally Saturated-seepage	S14 (Intermittent)	---

[1]Wetland No. refers to the number generated during the 2018 & 2021 field surveys within the 690 Line Rebuild Project area. This Wetland No. is keyed to those depicted on the 200 scale Aerial Maps (Attached to the Petition).

[2]Wetlands classified according to Cowardin et al 1979; PEM = Palustrine Emergent Wetland; PFO = Palustrine Forested Wetland; PSS = Palustrine Scrub-Shrub Wetland; POW = Palustrine Open Water.

[3]Associated Watercourse refers to the identification number assigned during the 2018 & 2021 field surveys to identify watercourses within the 690 Line Rebuild Project area.

[4] Vernal pools were identified in spring 2018 by Davison Environmental during the wetland delineation

Wetland Delineation Field Form

Wetland I.D.:	W1	Stream I.D.:	NA
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☒	Temporarily Flooded ☐
Permanently Saturated ☒	Seasonally Saturated – seepage ☐	Seasonally Saturated - perched ☐
Comments: Indian Lake fringe is seasonally flooded		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☒	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments: Predominantly emergent and scrub-shrub in maintained ROW		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☐	Tidal ☐
Watercourse Name:		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Common Cattail (Typha latifolia)	Swamp Rose (Rosa palustris)
Common Reed* (Phragmites australis)	Skunk Cabbage (Symplocarpus foetidus)
Reed Canarygrass* (Phalaris arundinacea)	
Specked Alder (Alnus rugosa)	
Silky Dogwood (Cornus amomum)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W2	Stream I.D.:	S2, S3, S4, S5 (Intermittent)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments: Hydrology is primarily seasonally saturated seepage with some smaller areas also being permanently saturated		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☒	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments: Wetland consists of a complex of emergent, scrub-shrub, and forest cover		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S2, S3, S4, S5		
Comments: Embedded intermittent watercourses		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Bush Honeysuckles* (Lonicera spp.)	Tearthumbs (Polygonum spp.)
Common Reed* (Phragmites australis)	Skunk Cabbage (Symplocarpus foetidus)
Sensitive Fern (Onoclea sensibilis)	
Specked Alder (Alnus rugosa)	
Bebb Willow (Salix bebbiana)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	NA	Stream I.D.:	S6 (Intermittent)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☐	Scrub-shrub ☐	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S6		
Comments: Intermittent watercourse may be ephemeral (subject to seasonal flows only)		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	NA	Stream I.D.:	S7 (Intermittent)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☐	Scrub-shrub ☐	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S7		
Comments: Intermittent watercourse may be ephemeral (subject to seasonal flows only)		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W3	Stream I.D.:	S1 (Intermittent)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☐	Scrub-shrub ☐	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments: Wetland is forested where it occurs outside of maintained ROW		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S1		
Comments: Intermittent watercourse drains south through ROW		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Red Maple (Acer rubrum)	
Skunk Cabbage (Symplocarpus foetidus)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W4	Stream I.D.:	S8
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☐	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments: Emergent in maintained ROW		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S8		
Comments: Low-flow channel width is approximately 2-4'wide		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Sensitive Fern (Onoclea sensibilis)	
Highbush Blueberry (Vaccinium corymbosum)	
Red Maple (Acer rubrum)	
Yellow Birch (Betula alleghaniensis)	
Tearthumbs (Polygonum spp.)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W5	Stream I.D.:	NA
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☐	Forested ☐
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: None		
Comments: None		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Sensitive Fern (Onoclea sensibilis)	
Tearthumbs (Polygonum spp.)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W6	Stream I.D.:	S9 (Intermittent)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☐	Scrub-shrub ☐	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S9		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Red Maple (Acer rubrum)	
Eastern Hemlock (Tsuga canadensis)	
Skunk Cabbage (Symplocarpus foetidus)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W7	Stream I.D.:	S10 (Unnamed Perennial)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☒
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☒	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments: Forested beyond maintained ROW		

WATERCOURSE TYPE:

Perennial ☒	Intermittent ☐	Tidal ☐
Watercourse Name: S10 (Unnamed Perennial)		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Red Maple (Acer rubrum)	
Highbush Blueberry (Vaccinium corymbosum)	
Spicebush (Lindera benzoin)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W8	Stream I.D.:	S11 (Unnamed Perennial)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☒
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☐	Forested ☒
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments: Forested beyond maintained ROW		

WATERCOURSE TYPE:

Perennial ☒	Intermittent ☐	Tidal ☐
Watercourse Name: S11 (Unnamed Perennial)		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Red Maple (Acer rubrum)	
Eastern Hemlock (Tsuga canadensis)	
Spicebush (Lindera benzoin)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W9	Stream I.D.:	S12 (Unnamed Perennial)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☒	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☒	Forested ☐
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☒	Intermittent ☐	Tidal ☐
Watercourse Name: S12 (Unnamed Perennial)		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☒ No ☐ Potential ☐	Other ☐
Vernal Pool Habitat Type: 'Cryptic'	
Comments: VP1	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Silky Dogwood (Cornus amomum)	
Skunk Cabbage (Symplocarpus foetidus)	
Sensitive Fern (Onoclea sensibilis)	
Tussock Sedge (Carex stricta)	
Cinnamon Fern (Osmunda cinnamomea)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W10	Stream I.D.:	S13 (Spring Brook)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☒	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☒	Forested ☐
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☒	Intermittent ☐	Tidal ☐
Watercourse Name: S13 (Spring Brook)		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Silky Dogwood (Cornus amomum)	
Skunk Cabbage (Symplocarpus foetidus)	
Specked Alder (Alnus rugosa)	
Tussock Sedge (Carex stricta)	
Cinnamon Fern (Osmunda cinnamomea)	

* denotes Connecticut Invasive Species Council invasive plant species

Wetland Delineation Field Form

Wetland I.D.:	W11	Stream I.D.:	S14 (Intermittent)
Flag Location Method:	Site Sketch ☐	GPS (sub-meter) located ☒	

WETLAND HYDROLOGY:

NONTIDAL ☒

Intermittently Flooded ☐	Artificially Flooded ☐	Permanently Flooded ☐
Semipermanently Flooded ☐	Seasonally Flooded ☐	Temporarily Flooded ☐
Permanently Saturated ☐	Seasonally Saturated – seepage ☒	Seasonally Saturated - perched ☐
Comments:		

TIDAL ☐

Subtidal ☐	Regularly Flooded ☐	Irregularly Flooded ☐
Irregularly Flooded ☐		
Comments:		

WETLAND TYPE:

SYSTEM:

Estuarine ☐	Riverine ☐	Palustrine ☒
Lacustrine ☐	Marine ☐	
Comments:		

CLASS:

Emergent ☒	Scrub-shrub ☒	Forested ☐
Open Water ☐	Disturbed ☐	Wet Meadow ☐
Comments:		

WATERCOURSE TYPE:

Perennial ☐	Intermittent ☒	Tidal ☐
Watercourse Name: S14		
Comments:		

SPECIAL AQUATIC HABITAT:

Vernal Pool Yes ☐ No ☒ Potential ☐	Other ☐
Vernal Pool Habitat Type:	
Comments:	

SOILS:

Are field identified soils consistent with NRCS mapped soils?	Yes ☒	No ☐

DOMINANT PLANTS:

Silky Dogwood (Cornus amomum)	
Bush Honeysuckles* (Lonicera spp.)	
Multiflora Rose* (Rosa multiflora)	
Skunk Cabbage (Symplocarpus foetidus)	

* denotes Connecticut Invasive Species Council invasive plant species

Attachment G: Vernal Pool Survey

Vernal Pool Survey

April 27, 2021 **DE Project No.: 2020-27**

Prepared For:	Eversource Energy 56 Prospect Street Hartford, CT 06103 Attn: Mark Pappalardo
Eversource Project Name:	690 Line Rebuild Project
Project Location:	Salisbury, Connecticut
Date(s) of Investigations:	May 2, 2018; May 21 and 27, 2020
Survey Methodology:	Visual & Audial Survey, Dip Netting

The vernal pool survey was performed by:

Davison Environmental, LLC

Eric Davison
Wildlife Biologist
Professional Wetland Scientist

INTRODUCTION

The following details vernal pool surveys conducted by Davison Environmental in support of The Connecticut Light and Power Company doing business as Eversource Energy's ("Eversource") petition to the Connecticut Siting Council for structure replacements along the 690 transmission line within an existing right-of-way ("ROW") in Salisbury, Connecticut (the "Project").

VERNAL POOL DEFINITION

Several vernal pool definitions have been developed by both regulatory authorities and conservation organizations. The Connecticut Department of Energy and Environmental Protection (CT DEEP) generally describes vernal pools on its website, but cautions that the data provided is informational in nature and should not supplant regulations of municipal inland wetlands agencies. CT DEEP describes vernal pools as *"small bodies of standing fresh water found throughout the spring*" that are "*usually temporary"* and "*result from various combinations of snowmelt, precipitation and high water tables associated with the spring season*".

Calhoun and Klemens (2002) *Best development practices: Conserving pool-breeding amphibians in residential and commercial developments in the northeastern United States* (BDP Manual) provides the following operational definition of vernal pools:

Vernal pools are seasonal bodies of water that attain maximum depths in the spring or fall, and lack permanent surface water connections with other wetlands or water bodies. Pools fill with snowmelt or runoff in the spring, although some may be fed primarily by groundwater sources. The duration of surface flooding, known as hydroperiod, varies depending upon the pool and the year; vernal pool hydroperiods range along a continuum from less than 30 days to more than one year. Pools are generally small in size (<2 acres), with the extent of vegetation varying widely. They lack established fish populations, usually as a result of periodic drying, and support communities dominated by animals adapted to living in temporary, fishless pools. In the region, they provide essential breeding habitat for one or more wildlife species including Ambystomid salamanders (Ambystoma spp., called "mole salamanders" because they live in burrows), wood frogs (Rana sylvatica), and fairy shrimp (Eubranchipus spp.).

Vernal pool physical characteristics can vary widely while still providing habitat for indicator species. "Classic" vernal pools are natural depressions in a wooded upland with no permanent hydrologic connection to other wetland systems. Anthropogenic depressions such as quarry holes, old farm ponds and borrow pits can also provide similar habitat. Often, vernal pools are depressions or impoundments embedded within larger wetland systems. These vernal pool habitats are commonly referred to as "cryptic" vernal pools.

Several species of amphibians depend on vernal pools for reproduction and development. These species are referred to as indicator (a.k.a. obligate) vernal pool species, and the presence of breeding adults, egg masses or larvae within a seasonally flooded wetland provides confirmation of a vernal pool.

Facultative vernal pool species are fauna that utilize but do not necessarily require vernal pools for reproductive success. Examples of facultative species include spotted turtles (*Clemmys guttata*) and four-toed salamander (*Hemidactylium scutatum*). These species may breed or feed in vernal pools, but are also capable of carrying out all phases of their lifecycle in other types of wetlands or water bodies. Evidence of breeding by facultative species alone is not considered indicative of the presence of a vernal pool.

EXISTING WETLANDS ALONG THE PROJECT ROW

Project wetlands are predominantly characterized by wetlands with a "saturated" hydrology. Mitsch and Gosselink (2007)[1] defines a saturated hydrology as a wetland with a substrate that is saturated for extended periods during the growing season, but standing water is rarely present. Wetlands with a saturated hydrology are not capable of supporting breeding by vernal pool indicator species, as they lack prolonged standing water. In order for successful breeding by vernal pool amphibians to occur, a wetland must have standing water from approximately March through June for most indicator species[2]. Such wetlands, referred to as seasonally flooded wetlands, provide optimal habitat for vernal pool indicator species. Additionally, while seasonally flooded conditions are optimal, permanently (or semi-permanently) flooded wetlands can also provide suitable breeding habitat, particularly if they occur in a forested landscape and contain shallow water with emergent and/or submergent vegetation.

VERNAL POOL SURVEY

Vernal pool surveys were conducted within the Project area in 2018 and 2020 as part of wetland delineation work as well as bog turtle (*Glyptemys insculpta*) surveys. One vernal pool was identified within Wetland 9 and was labeled "VP 1" on the Project mapping.

Vernal Pool 1 is cryptic vernal pool (as opposed to classic) located in a large wetland system northwest of the northerly terminus of Drum Road, west of Structure 1057. The wetland includes emergent and scrub-shrub cover types within the maintained ROW and is forested beyond the maintained ROW. One indicator species, the wood frog (*Rana sylvatica*), was confirmed breeding. A comprehensive list of the species observed within the vernal pool (and bordering wetland) is provided in Table 1.

Table 1. Comprehensive Species List, Vernal Pool 1 / Wetland 9 - Drum Road

Common Name	Scientific Name	Life Stage/Observation
Gray Treefrog	*Hyla versicolor*	Adult, calling
Green Frog	*Rana clamitans*	Adult
Pickerel Frog	*Rana palustris*	Adult
Wood Frog	*Rana sylvatica*	40 egg masses in 2018; tadpoles observed in 2020
Gartersnake	*Thamnophis sirtalis sirtalis*	Adult
Northern Water Snake	*Nerodia sipedon*	Adult

[1] Mitsch, W.J. and Gosselink, J.G. 2007. Wetlands, fourth edition. John Wiley and Sons, Inc.
[2] The indicator species marbled salamander (*Ambystoma opacum*) breeds in late-summer and fall, with larval development throughout the winter and spring.

RECOMMENDED BEST MANAGEMENT PRACTICES

The following measures are recommended to avoid or minimize impacts on the above-referenced vernal pools during construction:

A. During construction, work within the vernal pool depression should be avoided;

B. No new permanent access roads or work pads should be constructed or gravel fill deposited within the vernal pool envelope (0-100 feet);

C. Existing scrub-shrub vegetation within 25 feet of the vernal pool should be maintained, consistent with ROW vegetation management requirements. If low growing (scrub-shrub) vegetation must be removed adjacent to the vernal pool, the cut vegetation (slash) will be left in place to serve as recruitment for leaf litter and coarse woody debris;

Attachment:

Photographs of Vernal Pool 1

Photo 1: View of Vernal Pool 1 looking north at the pool's continuation to the north (off ROW).

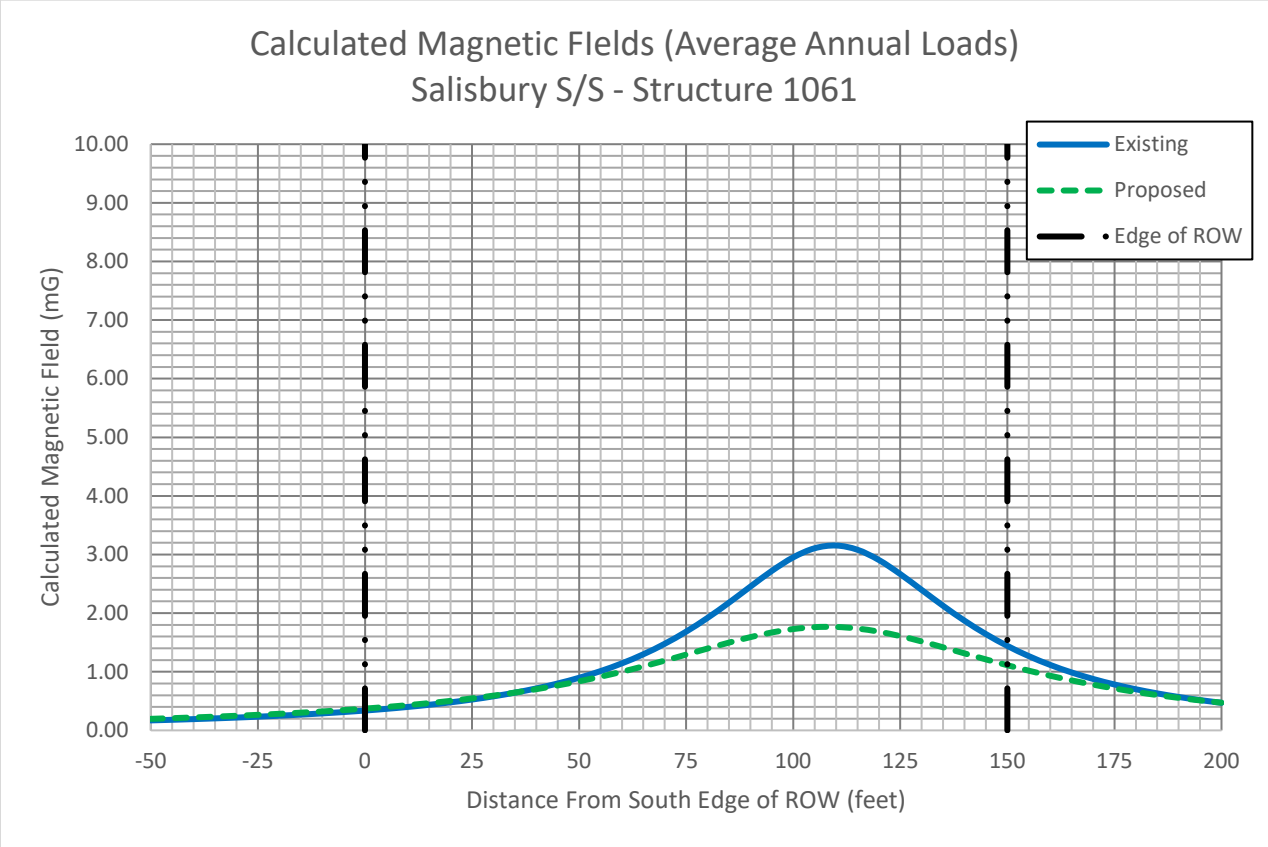
Photo 2: View of Vernal Pool 1 looking south into maintained ROW.

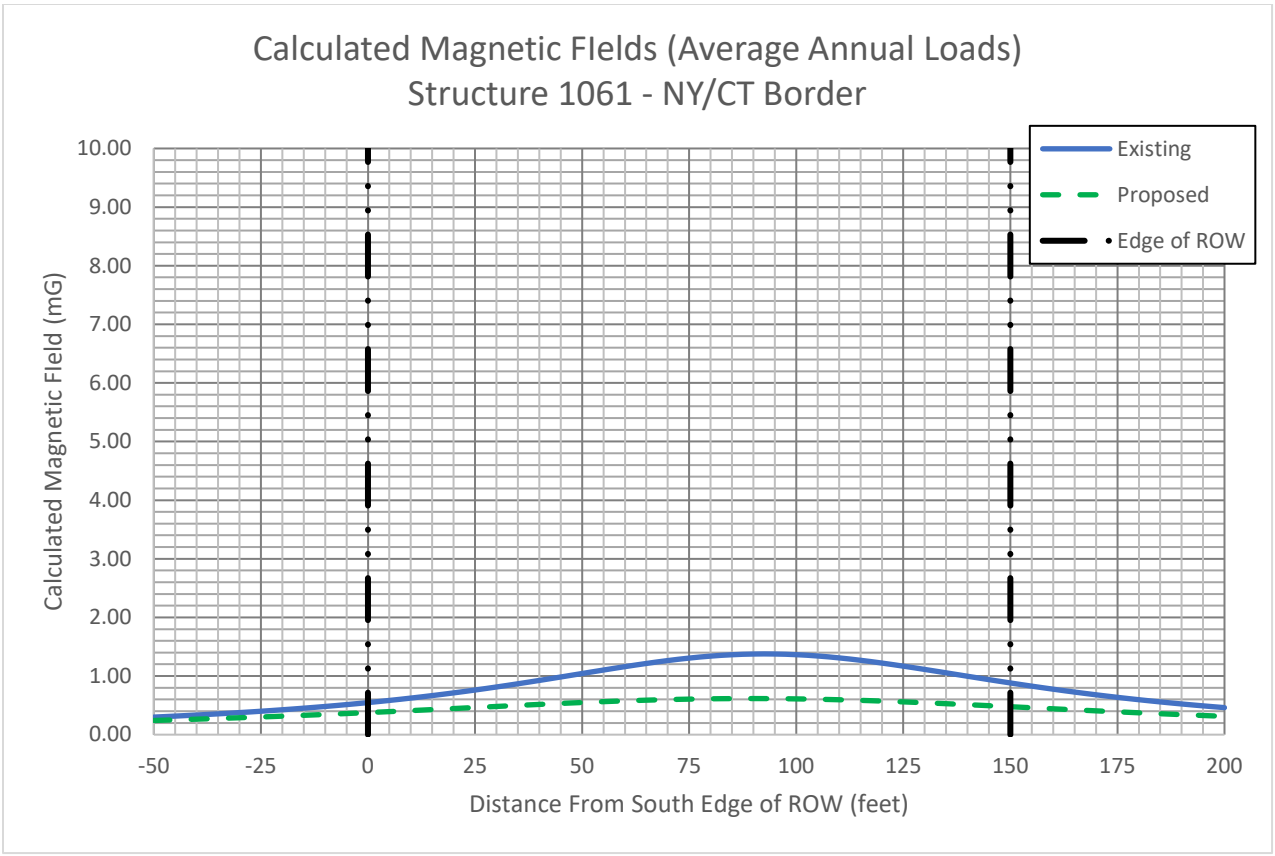
Attachment H: EMF Graphs

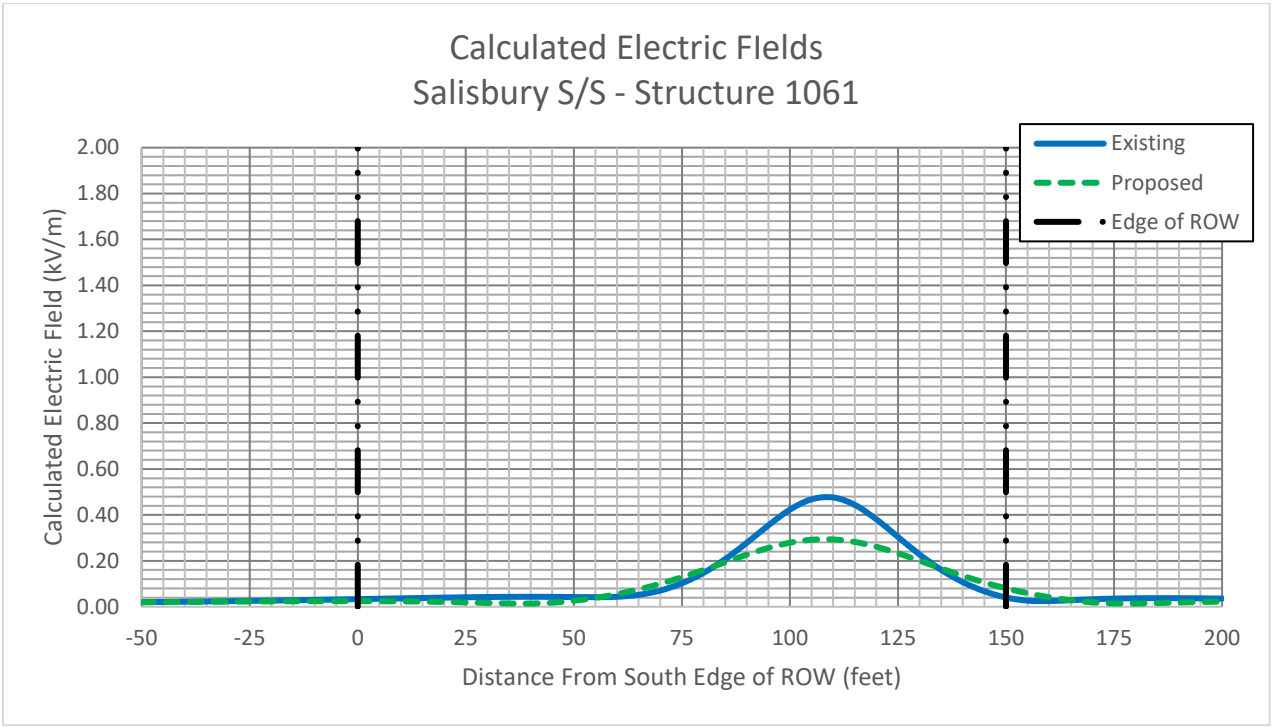
Salisbury S/S - Structure 1061		South ROW Edge	Max in ROW	North ROW Edge
Magnetic Fields (mG)	Existing	0.37	3.15	1.44
	Proposed	0.37	1.76	1.11
Electric Fields (kV/m)	Existing	0.03	0.48	0.04
	Proposed	0.02	0.29	0.08

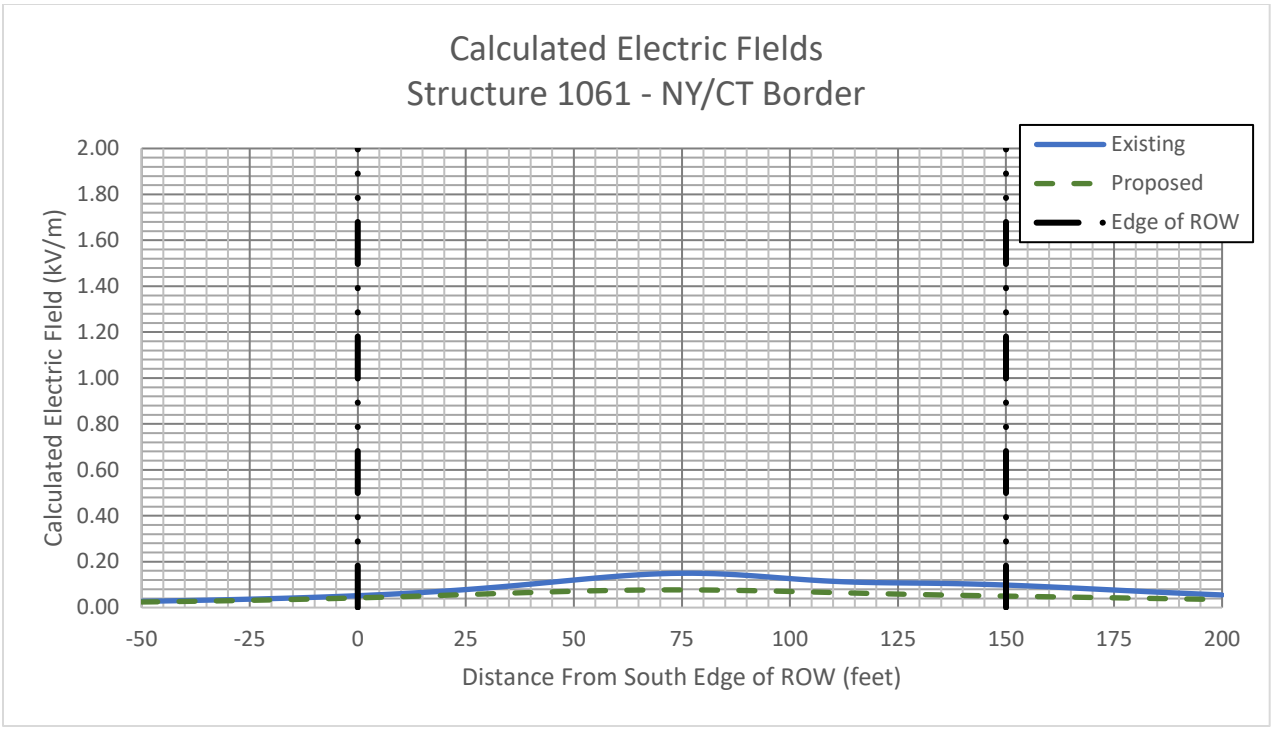
Structure 1061 - NY/CT Border		South ROW Edge	Max in ROW	North ROW Edge
Magnetic Fields (mG)	Existing	0.55	1.38	0.88
	Proposed	0.38	0.62	0.48
Electric Fields (kV/m)	Existing	0.05	0.15	0.10
	Proposed	0.04	0.08	0.05

	Magnetic Field (mG)	Electric Field (kV/m)
ICNIRP	2000	4.2
ICES	9040	5 (in General)
		10 (on ROW)




Calculated Magnetic FIelds (Average Annual Loads)
Structure 1061 - NY/CT Border
Existing
Proposed
Edge of ROW
Calculated Magnetic FIeld (mG)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-50
-25
0
25
50
75
100
125
150
175
200
Distance From South Edge of ROW (feet)


Calculated Electric FIelds
Salisbury S/S - Structure 1061
Existing
Proposed
Edge of ROW
Calculated Electric FIeld (kV/m)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-50
-25
0
25
50
75
100
125
150
175
200
Distance From South Edge of ROW (feet)


Calculated Electric FIelds
Structure 1061 - NY/CT Border
Calculated Electric Field (kV/m)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-50
-25
0
25
50
75
100
125
150
175
200
Distance From South Edge of ROW (feet)
Existing
Proposed
Edge of ROW

Attachment I: Abutters Letter and Affidavit of Notice of Service

EVERSOURCE

P.O. Box 270
Hartford, CT 06141-0270

July 13, 2021

Dear Neighbor,

Maintaining infrastructure is one of the many ways Eversource supports the safe and secure transmission of electricity throughout the region. We are submitting a petition to the Connecticut Siting Council (CSC) for a proposed transmission line and structure replacement project in your area.

Proposed Project Information

The proposed project, called the 690 Line Rebuild Project ("Project"), includes replacing 10 existing lattice tower structures with weathering steel monopoles, adding one additional monopole structure, and replacing the existing line with a new line along the approximately 1.6 mile right-of-way (powerline corridor) from the Salisbury Substation located at 316 Indian Mountain Road in Salisbury to the eastern shoreline of Indian Lake off Millerton Road in Sharon just before the Connecticut/New York border.

The existing ground wire located at the top of the structures is also proposed to be replaced with new fiber optic communication wire (called OPGW) along the same route. The OPGW improves electric reliability by enabling efficient communication between substations.

In addition to the line and structure work, Eversource is proposing to install temporary back-up generation at Falls Village Substation located at 35 Water Street in Canaan, CT and at the Salisbury Substation. We are making this request in the unlikely event of an interruption of the power supply during construction of the Project. It is not expected that the generation units will run except during initial testing or in the unlikely event of a loss of power during construction.

This proposed work is necessary to ensure the continued reliability, safety and security of the transmission of electricity throughout the region. If the CSC approves the proposed work, construction is expected to begin in the Fall of 2021 and conclude by the end of 2021. Restoration of any affected areas will continue into the Spring of 2022.

Contact Information

Eversource is committed to being a good neighbor and doing our work with respect for you and your property. For more information please call our project hotline at 1-800-793-2202 or send an email to ProjectInfo@eversource.com.

If you would like to send comments regarding Eversource's petition to the CSC, please send them via email to siting.council@ct.gov or send a letter to the following address: Melanie Bachman, Executive Director, Connecticut Siting Council, Ten Franklin Square, New Britain, CT 06051.

Sincerely,

Nicholas Pellon

Nicholas Pellon
Eversource Project Manager – 690 Line Rebuild Project

Owner (First Name)	Co-Owner (First Name)	Address (Mailing)	City (Mailing)	State (Mailing)	Zip Code (Mailing)
JOHN G BRETT TRUSTEE OF THE JOHN G BRETT REV TRUST UAD10		33 DRUM ROAD	SHARON	CT	06069
BARRY S PINCHOFF	BARBARA ZUCKER-PINCHOFF	34 DRUM ROAD	SHARON	CT	06069
BARRY GILL	PILAR TORREJON	400 E 84TH ST APT 23D	NEW YORK	NY	10028
GEORGE S MASON	PAMELA K WILSON	4 JUNIPER LANE	LAKEVILLE	CT	06039
CARL K OPPENHEIMER		119 W 57TH STREET STE 1515	NEW YORK	NY	10019
BRIAN P QUINIF	KRISTINE OCONNELL	30 WASHINGTON ST APT 41	BROOKLYN	NY	11201
LUCY P ALLEN	JOHN B RHODES C/O WOODMARK CORP	65 N MAPLE AVE STE 300	RIDGEWOOD	NJ	07450
STEVEN J BURDEN	RUTH LEHMANN	PO BOX 627	SHARON	CT	06069
SHARON LAND TRUST		PO BOX 1027	SHARON	CT	06069
ANN C TROTTA		238 MUDGE POND ROAD	SHARON	CT	06069
OTTO VON AHN		PO BOX 213	SHARON	CT	06069
GREGORY FRANKS		23 GLENBERRY COURT	PHOENIX	AZ	21131
PHILIP OPPENHEIMER		17 JUNIPER LEDGE LANE	LAKEVILLE	CT	06039
MARY ELIZABETH FEEMAN		PO BOX 1748	LAKEVILLE	CT	06039
311 IMR LLC		4 JUNIPER LEDGE LANE	LAKEVILLE	CT	06039
EMILY ELLIOT		310 INDIAN MOUNTAIN ROAD	LAKEVILLE	CT	06039
PATRICIA & JOHN STIMPSON TR		23 VALLEY ROAD	LAKEVILLE	CT	06039
FIRSTLIGHT HYDRO GEN CO.		PO BOX 5002	NEW MILFORD	CT	06776
US DEPARTMENT OF INTERIOR		1849 C. STREET NORTHWEST	WASHINGTON	DC	20240

AFFIDAVIT OF SERVICE OF NOTICE

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF NEW LONDON)

Sec. 16-50j-40 of the Regulations of Connecticut State Agencies ("RCSA") provides that proof of notice to the affected municipalities, property owners and abutters shall be submitted with a petition for declaratory ruling to the Connecticut Siting Council ("Council"). In accordance with that RCSA section, I hereby certify that I caused notice of the petition for a declaratory ruling of The Connecticut Light and Power Company doing business as Eversource Energy to be served by mail or courier upon the following municipal official:

- Henry Todd, First Selectman
  Town of Canaan (Falls Village)
  Falls Village Town Hall
  108 Main Street
  P.O. Box 47
  Falls Village, CT 06031

- Brent M. Colley, First Selectman
  Town of Sharon
  Sharon Town Hall
  63 Main Street
  P.O. Box 385
  Sharon, CT 06069

- Curtis Rand, First Selectman
  Town of Salisbury
  Town Hall
  27 Main Street
  P.O. Box 548
  Salisbury, CT 06068

I also certify that I caused notice of the proposed modifications to be served by mail or courier upon owners of abutting properties shown on the List of Abutters included in Attachment I of the Petition.

Nicholas Pellon
Project Manager

On this the 13th day of July 2021, before me, the undersigned representative, personally appeared, Nicholas Pellon, known to me (or satisfactorily proven) to be the person whose name is subscribed to the foregoing instrument and acknowledged that he executed the same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

Notary Public/My Commission expires: _____

Commissioner of the Superior Court/ Juris No.: 413393