



# Installation Manual

## Generator Set

**QSK78 Engine with PowerCommand<sup>®</sup> 3200 Control**

DQLA (Spec A)

DQLB (Spec A)

-

**California**

**Proposition 65 Warning**

**Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.**

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# IMPORTANT SAFETY INSTRUCTIONS

**SAVE THESE INSTRUCTIONS** – This manual contains important instructions that should be followed during installation and maintenance of the generator and batteries.

**Before operating the generator set (genset)**, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

**⚠ DANGER** *This symbol warns of immediate hazards which will result in severe personal injury or death.*

**⚠ WARNING** *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

**⚠ CAUTION** *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

## FUEL AND FUMES ARE FLAMMABLE

Fire, explosion, and personal injury or death can result from improper practices.

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use zinc coated or copper fuel lines with diesel fuel.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

## EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.
- Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

## MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect battery charger from its AC source, then disconnect starting batteries, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

## DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can cause an engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. Do not operate a genset where a flammable vapor environment can be created by fuel spill, leak, etc., unless the genset is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the genset are solely responsible for operating the genset safely. Contact your authorized Cummins Power Generation distributor for more information.

## **ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH**

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment. Do not wear jewelry. Jewelry can short out electrical contacts and cause shock or burning.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

## **MEDIUM VOLTAGE GENERATOR SETS (601V to 15kV)**

- Medium voltage acts differently than low voltage. Special equipment and training is required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Due to the nature of medium voltage electrical equipment, induced voltage remains even after the equipment is disconnected from the power source. Plan the time for maintenance with authorized personnel so that the equipment can be de-energized and safely grounded.

## **GENERAL SAFETY PRECAUTIONS**

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the engine.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breathe or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator, turbo charger and exhaust system.

**KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE**

# 1. Introduction

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## ABOUT THIS MANUAL

This manual provides installation instructions for the generator set models listed on the front cover. This includes the following information:

**Mounting Recommendations** - for fastening generator set to base and space requirements for normal operation and service.

**Mechanical and Electrical Connections** - covers most aspects of the generator set installation.

**Prestart** – checklist of items or procedures needed to prepare generator set for operation.

**Initial Startup** – test complete system to ensure proper installation, satisfactory perfor-

mance, and safe operation. Refer to Operators Manual for troubleshooting information.

**Installation Checklist** – reference checks upon completion of installation.

This manual DOES NOT provide application information for selecting a generator set or designing the complete installation. If it is necessary to design the various integrated systems (fuel, exhaust, cooling, etc.), additional information is required. Review standard installation practices. For engineering data specific to the generator set, refer to the *Specification* and *Data Sheets*. For application information, refer to Application Manual T-030, “Liquid Cooled Generator Sets”.

## INSTALLATION OVERVIEW

These installation recommendations apply to typical installations with standard model generator sets. Whenever possible, these recommendations also cover factory designed options or modifications. However, because of the many variables in any installation, it is not possible to provide specific recommendations for every situation. If there are any questions not answered by this manual, contact your nearest Cummins Power Generation distributor for assistance.

### Application and Installation

A standby power system must be carefully planned and correctly installed for proper operation. This involves two essential elements: application and installation.

**Application** (as it applies to generator set installations) refers to the design of the complete standby power system that usually includes power distribution equipment, transfer switches, ventilation equipment, mounting pads, and cooling, exhaust, and fuel systems. Each component must be correctly designed so the complete system will function as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers or other trained specialists are responsible for the design of the complete standby system and for selecting the materials and products required.

**Installation** refers to the actual set-up and assembly of the standby power system. The installers set up and connect the various components of the system as specified in the system design plan. The complexity of the standby system normally requires the special skills of qualified electricians, plumbers, sheetmetal workers, etc. to complete the various segments of the installation. This is necessary so all components are assembled using standard methods and practices.

### Safety Considerations

The generator set has been carefully designed to provide safe and efficient service when properly

installed, maintained, and operated. However, the overall safety and reliability of the complete system is dependent on many factors outside the control of the generator set manufacturer. To avoid possible safety hazards, make all mechanical and electrical connections to the generator set exactly as specified in this manual. All systems external to the generator (fuel, exhaust, electrical, etc.) must comply with all applicable codes. Make certain all required inspections and tests have been completed and all code requirements have been satisfied before certifying the installation is complete and ready for service.

### Standby Heating Devices

In accordance with NFPA 110, Cummins Power Generation recommends installing diesel standby generator sets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is above 40°F (4°C). NFPA also requires that the engine jacket water coolant be maintained at a minimum of 90°F (32°C) and, for most applications, accept the emergency load in 10 seconds or less. Although most Cummins Power Generation generator sets will start in temperatures down to -25°F (-32°C) when equipped with engine jacket water coolant heaters, it might take more than 10 seconds to warm the engine up before a load can be applied when ambient temperatures are below 40°F (4°C).

The **Engine Cold (Code 1435)** message, in conjunction with illumination of the Warning LED, is provided to meet the requirements of NFPA 110. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 70°F (21°C). In applications where the ambient temperature falls below 40°F (4°C), a cold engine may be indicated even though the coolant heaters are connected. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

## 2. Specifications

MODEL	DQLA	DQLB
Cummins Diesel Series	QSK78 (60 Hz)	QSK78 (50 Hz)
Generator kW Rating	See Genset Nameplate for rating information.	
Oil Capacity, Maximum Standby Prime	Qts (L) 312 (295) 492 (465)	
*Oil Type		
Engine Fuel Connection Inlet/Outlet Thread Size	Refer to Generator Outline Drawing	
**Fuel Consumption Standby/Full Load	gph (L/hr) 172 (652)	gph (L/hr) 174 (662)
Exhaust Outlet Size Maximum Allowable Back Pres. H <sub>2</sub> O kPa	Refer to Generator Outline Drawing  27 in (686 mm) 6.7	
Electrical System Starting Voltage Battery Group number CCA (minimum) Cold Soak @ 0°F (-18° C)	24 Volts DC Four, 12 Volt 8D  1800	
* Refer to Cummins QSK78 Series Engine Operation and Maintenance Manual for lubricating oil recommendations/specifications.		
** Refer to Data Sheet for other applications.		

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# 3. Mounting the Generator Set

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## GENERAL

Generator set installations must be engineered so the generator set will function properly under the expected load conditions. Use these instructions as a general guide only. Follow the instructions of the consulting engineer when locating or installing any components. The complete installation must comply with all local and state building codes, fire ordinances, and other applicable regulations.

Requirements to be considered prior to installation:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of generator set air
- Discharge of exhaust gases

- Non-combustible mounting surface.
- Electrical connections
- Accessibility for operation and servicing
- Noise levels
- Vibration isolation

## LOCATION

Generator set location is decided mainly by related systems such as ventilation, wiring, fuel, and exhaust. The set should be located as near as possible to the main power service entrance. Exhaust must not be able to enter or accumulate around inhabited areas.

Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions.

## **⚠ WARNING**

**INCORRECT INSTALLATION, SERVICE OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE TRAINED AND EXPERIENCED TO PERFORM ELECTRICAL AND MECHANICAL COMPONENT INSTALLATION.**

## IMPORTANT

**DEPENDING ON YOUR LOCATION AND INTENDED USE, FEDERAL, STATE OR LOCAL LAWS AND REGULATIONS MAY REQUIRE YOU TO OBTAIN AN AIR QUALITY EMISSIONS PERMIT BEFORE BEGINNING INSTALLATION OF YOUR GENSET. BE SURE TO CONSULT LOCAL POLLUTION CONTROL OR AIR QUALITY AUTHORITIES BEFORE COMPLETING YOUR CONSTRUCTION PLANS.**

## MOUNTING

Generator sets are mounted on a steel skid that provides proper support. The engine-generator assembly is isolated from the skid frame by rubber mounts that provide adequate vibration isolation for normal installations. Where required by building codes or special isolation needs, generator sets may be mounted on rubber pads or mechanical spring isolators. The use of unapproved isolators may result in harmful resonances and may void the genset warranty.

Mount the generator set on a substantial and level base such as a concrete pad. A non-combustible material must be used for the pad.

Use 3/4 inch anchored mounting bolts to secure the vibration isolators to the base. Secure the vibration isolators to the skid using flat or bevel washer and hexagonal nut for each bolt (see Figure 3-1). The 1-1/2 x 6 inch pipe inserted over the mounting bolts allows minor adjustment of the bolts to align them to the holes in the subbase or vibration isolator.

Locate the isolators as shown on the generator set *Outline Drawing* referenced in the *Data Sheet*.

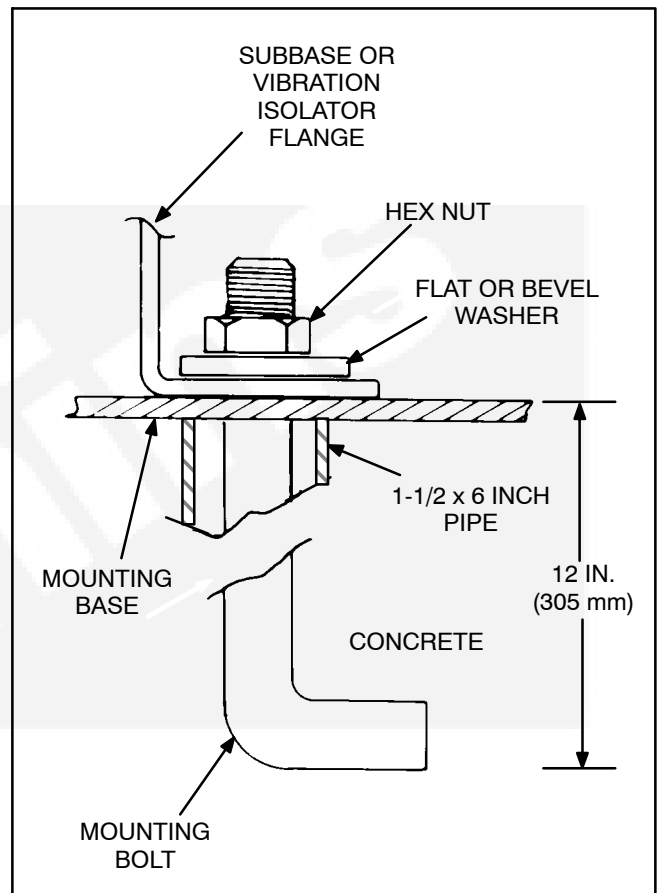


FIGURE 3-1. BOLT DIAGRAM

## ACCESS TO SET

Generally, at least 1 meter (3 feet) of clearance should be provided on all sides of the generator set for maintenance and service access. A raised foundation or slab of 150 mm (6 inches) or more above floor level will make servicing easier.

Lighting should be adequate for operation, maintenance and service operations and should be connected on the load side of the transfer switch so that it is available at all times.



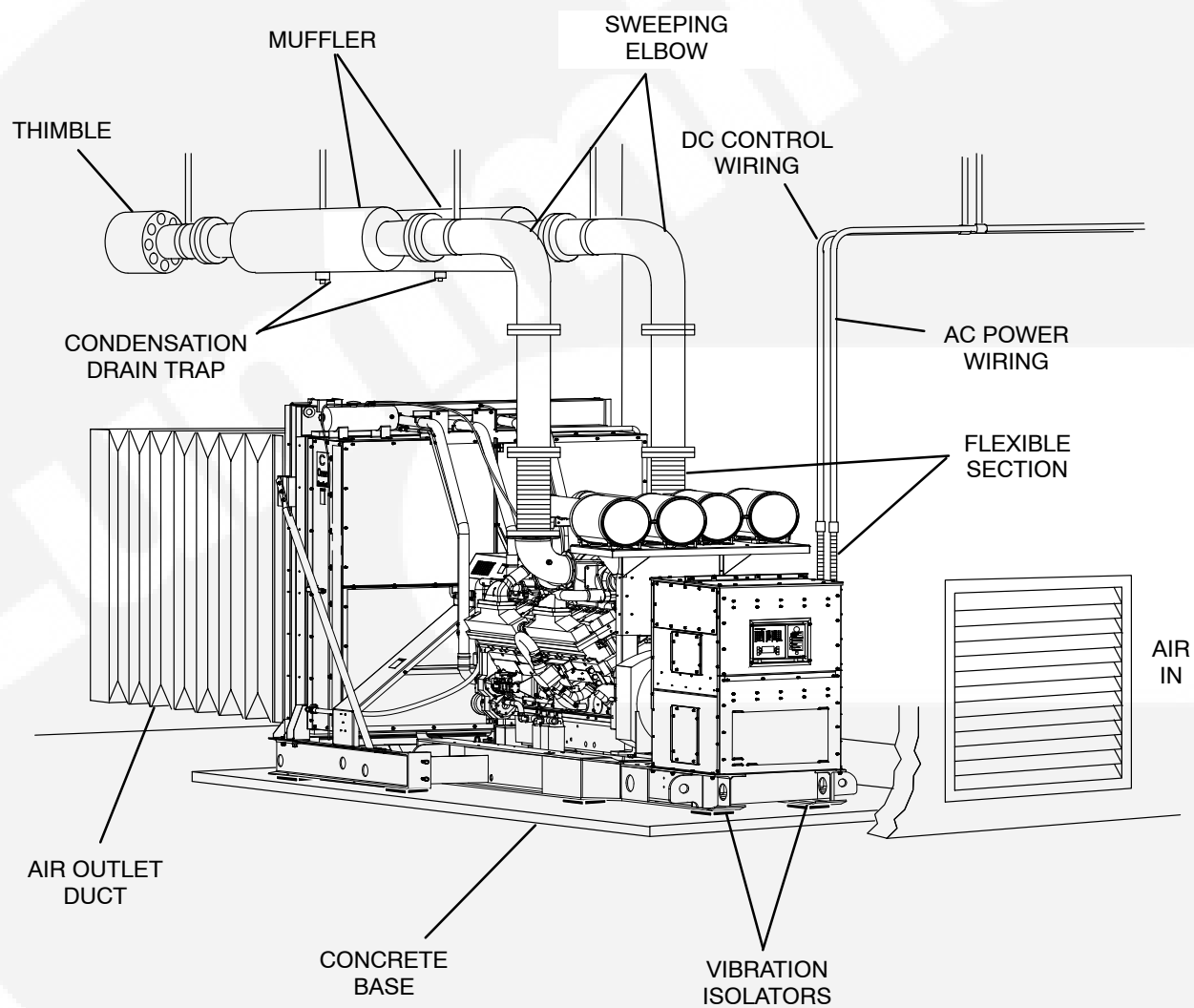


FIGURE 3-2. TYPICAL INSTALLATION

## VIBRATION ISOLATORS

### Installation and Adjustment Procedure (Optional Spring Type)

1. Place the vibration isolators (Figure 3-3) on the genset support structure. The isolators should be shimmed or grouted to ensure that all of the isolator bases are within 0.25 inch (6 mm) elevation of each other. The surface that the isolator bases rest on must also be flat and level.
2. Loosen the side snubber lock nuts so that the top plate of the isolator is free to move vertically and horizontally. Be sure that the top plate is correctly aligned with the base and springs.
3. Place the genset onto the isolators while aligning the skid's mounting with the threaded isolator hole. The top plates will move down and approach the base of the isolator as load is applied.
4. Once the genset is in position, the isolators may require adjusting so that the set is level.

The isolators are adjusted by inserting the leveling bolt through the skid and into the isolator (the leveling bolt's locking nut should be threaded up towards the bolt head).

The leveling bolt will adjust the clearance between the top plate and the isolator base. A nominal clearance of 0.25 inch (6 mm) or greater is desired. This will provide sufficient clearance for the rocking that occurs during startup and shutdown. If the 0.25 inch (6 mm) clearance is not present, turn the leveling bolt until the desired clearance is achieved.

5. The genset may not be level yet; therefore, adjust the leveling bolts until the set is level and sufficient clearance still remains. (Clearance on all isolators should be roughly equal). Once all isolators have been set, lock the leveling bolt in place with the lock nut.
6. The snubber nuts must remain loose and therefore provide better isolation between the genset and support structure.

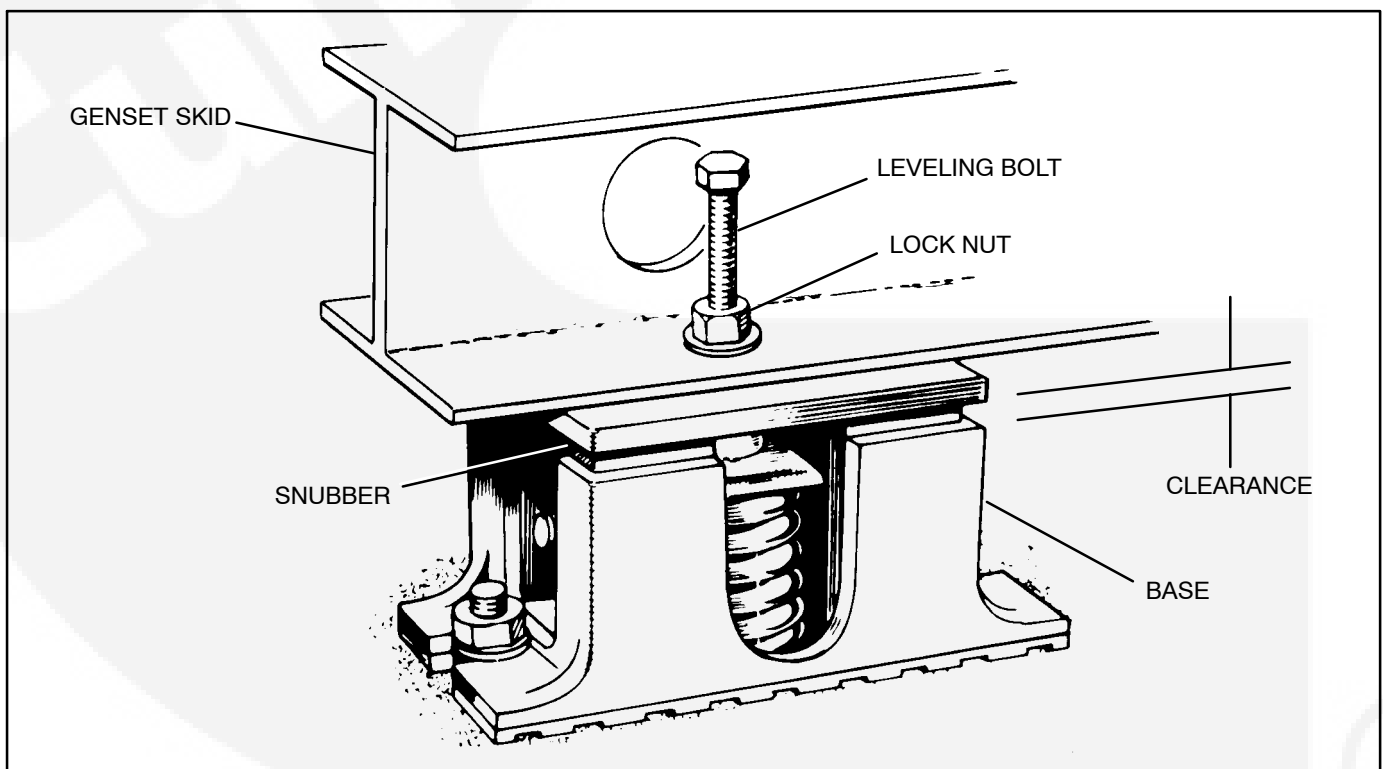


FIGURE 3-3. VIBRATION ISOLATOR (SPRING TYPE)

## Installation and Adjustment Procedure (Rubber Type)

1. Place the vibration isolators (Figure 3-4) on the genset support structure. The isolators should be shimmed to ensure that all of the isolator

bases are within 0.25 inch (6 mm) elevation of each other. The surface that the isolator bases rest on must also be flat and level.

2. Place the genset onto the isolators while aligning the skid's mounting with the threaded isolator hole.

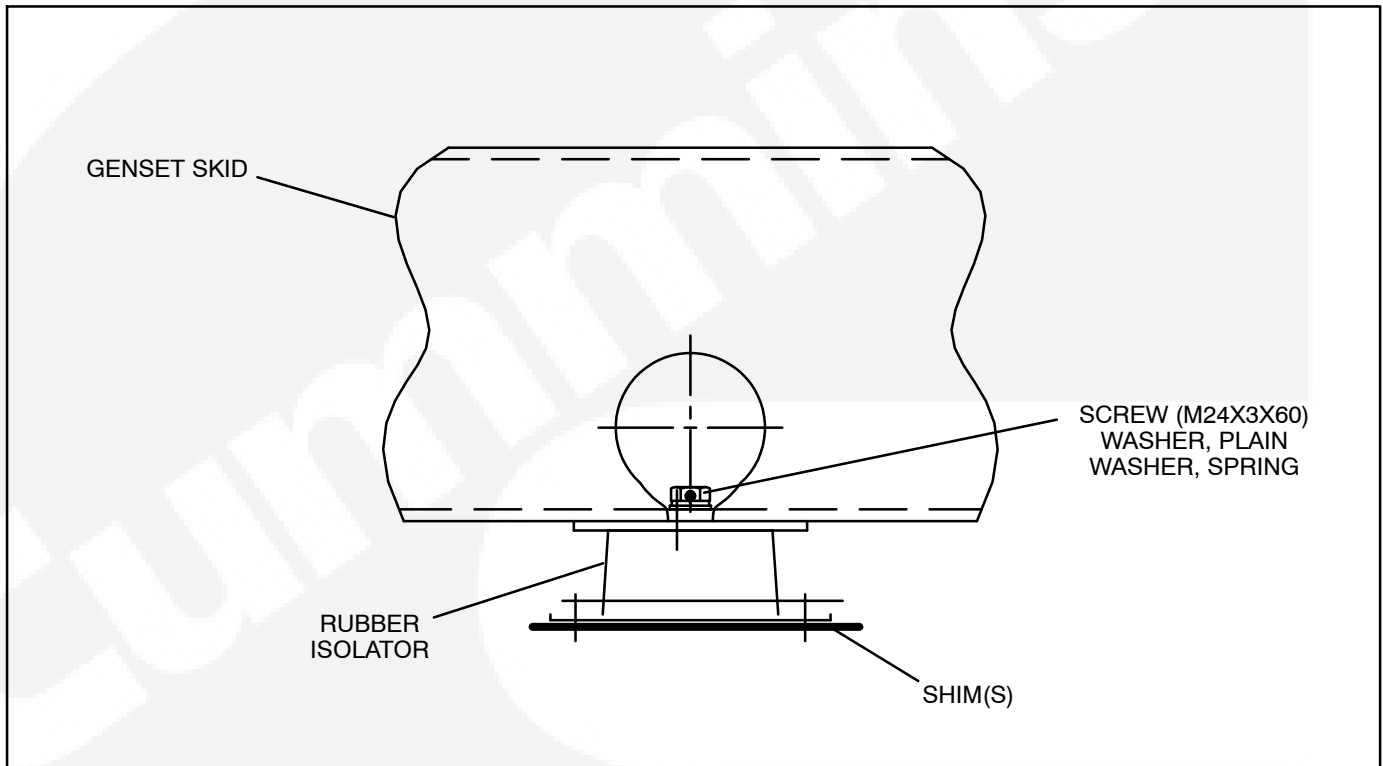


FIGURE 3-4. VIBRATION ISOLATOR (RUBBER TYPE)

## CHECK GENERATOR TO ENGINE ALIGNMENT

Proper alignment of the generator and engine assemblies is necessary to avoid premature wear and excessive vibration. Checking the alignment of the generator set **must** be performed before initial start-up.

Complete the following alignment procedure after the generator set skid is leveled and secured to the mounting base.

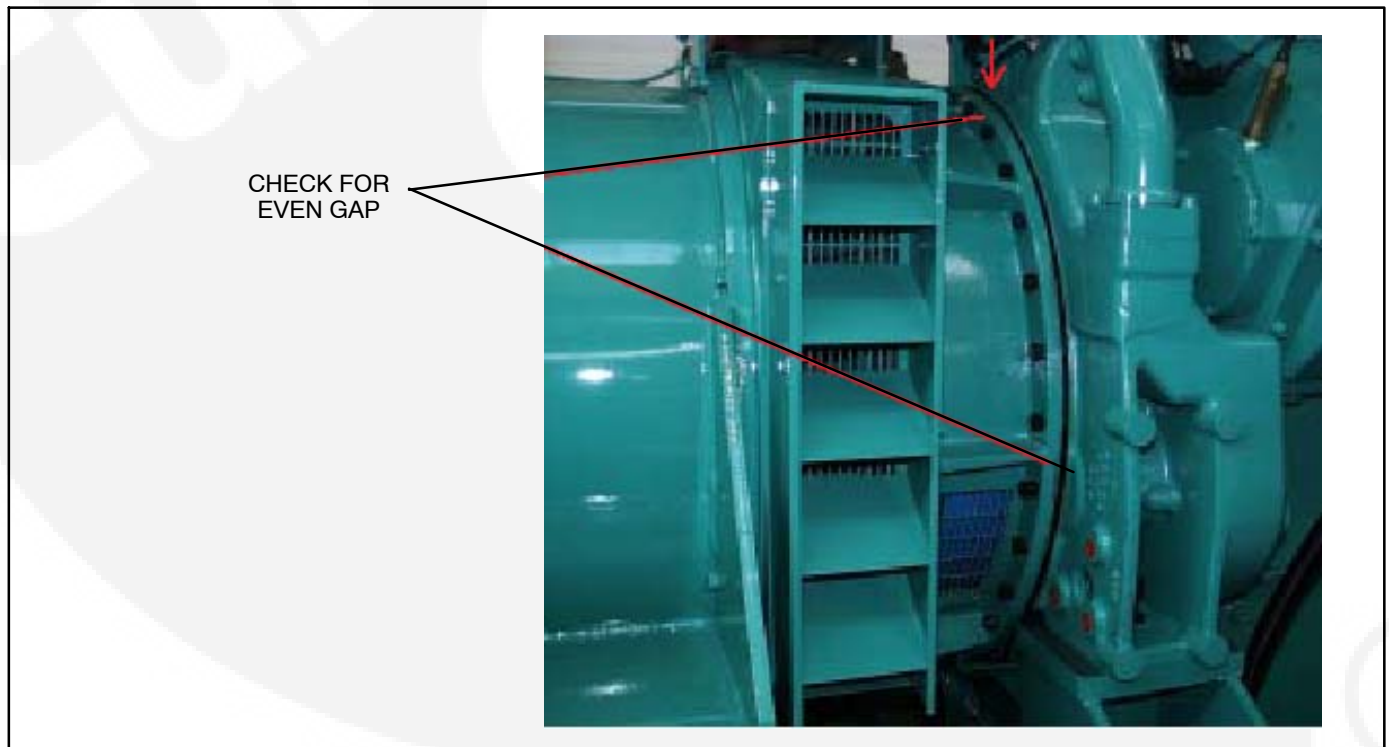
1. Loosen the 23 M12x45 bolts used on the engine/alternator coupling housing (Figure 3-5).
2. Using a feeler gauge, check the mating face to the engine crankcase flywheel housing. The gap must be the same at all locations.

If the gap is even, the alternator is correctly shimmed and aligned. Tighten all 23 bolts on the alternator housing using a tightening sequence pattern. Torque to 72 ft-lbs (98 Nm).

If gap varies, the generator to engine is misaligned (realign the alternator to the engine using the following steps).



**FIGURE 3-5. ENGINE/ALTERNATOR COUPLING HOUSING**



**FIGURE 3-6. GENERATOR TO ENGINE ALIGNMENT**

3. Loosen the four alternator mounting bolts (Figure 3-7).

**⚠ WARNING** *To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.*

**⚠ CAUTION** *Improper generator assembly rigging and handling can result in damage to stator and rotor assemblies. Lift the generator by hoisting at lifting eyes only. Inspect the sling and attachments for obvious defects. Make sure the generator is adequately hooked/strapped to maintain level control of assembly while lifting and moving.*

4. Attach shackles to the two alternator lifting points (front and back) as shown in Figure 3-7. Only these points should be used to lift the alternator to make sure it is balanced and stable during lift.

5. Lift the alternator to allow the alternator coupling housing to butt up squarely to the engine flywheel housing. Perform this operation slowly and carefully.

6. With alternator positioned squarely to the engine flywheel housing, tighten all 23 bolts on the alternator housing using a tightening sequence pattern.

7. The alternator housing is now flush to the engine housing. Measure the distance between all four alternator mounting feet and the skid mounting pads using feeler gauges. Shim as needed (add or remove shims) beneath the alternator mounting feet to align the alternator with the engine and eliminate gaps.

8. Lower hoist and hand tighten the four alternator mounting bolts. Repeat steps 1 and 2. When proper alignment is achieved, torque the four alternator mounting bolts to 522 ft-lbs (710 Nm).

ALTERNATOR  
MOUNTING BOLTS (4)

SHIM(S)



ALTERNATOR LIFTING  
EYES (4)



**FIGURE 3-7. ALTERNATOR COMPONENTS**

## 4. Mechanical Connections

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### GENERAL

The generator set mechanical system installation includes connecting the fuel, exhaust, ventilation and cooling systems. Before starting any type of fuel installation, all pertinent state and local codes must be complied with and the installation must be inspected before the unit is put in service.

### FUEL SYSTEM

Cummins engines normally use ASTM No. 2 Diesel fuel. They will, however, operate on alternate diesel fuels within the specifications shown in the Cummins *QSK78 Series Engine Operation and Maintenance Manual*.

In all fuel system installations, cleanliness is of the utmost importance. Make every effort to prevent entrance of moisture, dirt or contaminants of any kind into the fuel system. Clean all fuel system components before installing.

**A fuel filter/strainer/water separator of 100-120 mesh or equivalent (approximately 150 microns nominal) must be fitted between either the main tank and day tank or between the main tank and the engine.**

Use only compatible metal fuel lines to avoid electrolysis when fuel lines must be buried. Buried fuel lines must be protected from corrosion.

**⚠ CAUTION** *Never use galvanized or copper fuel lines, fittings or fuel tanks. Condensation in the tank and lines combines with the sulfur in diesel fuel to produce sulfuric acid. The molecular structure of the copper or galvanized lines or tanks reacts with the acid and contaminates the fuel.*

An electric solenoid valve in the supply line is recommended for all installations and required for indoor automatic or remote starting installations. Connect the solenoid wires to the genset "Switched B+" circuit to open the valve during generator set operation.

Separate fuel return lines to the day tank or supply tank must be provided for each generator set in a multiple-set installation to prevent the return lines of idle sets from being pressurized. Fuel return lines must not contain a shutoff device. Engine damage

will occur if the engine is run with the return fuel lines blocked or restricted.

**⚠ CAUTION** *Never install shutoff device in fuel return line(s). If fuel return line(s) is blocked or exceeds fuel restriction limit, engine damage will occur.*

**Fuel Return Restriction (or Pressure) Limit:** Fuel return drain restriction (consisting of friction head and static head) between the engine injector return line connection and the fuel tank must not exceed the limit stated in the *Generator Set Data Sheet*.

### Fuel Lines – Routing

A flexible fuel hose(s) or section of flexible fuel hose(s) must be used between the engine's fuel system and fuel supply and return line(s) to protect the fuel system from damage caused by vibration, expansion and contraction. Flexible lines for connecting between the engine and the stationary fuel lines are supplied as standard equipment.

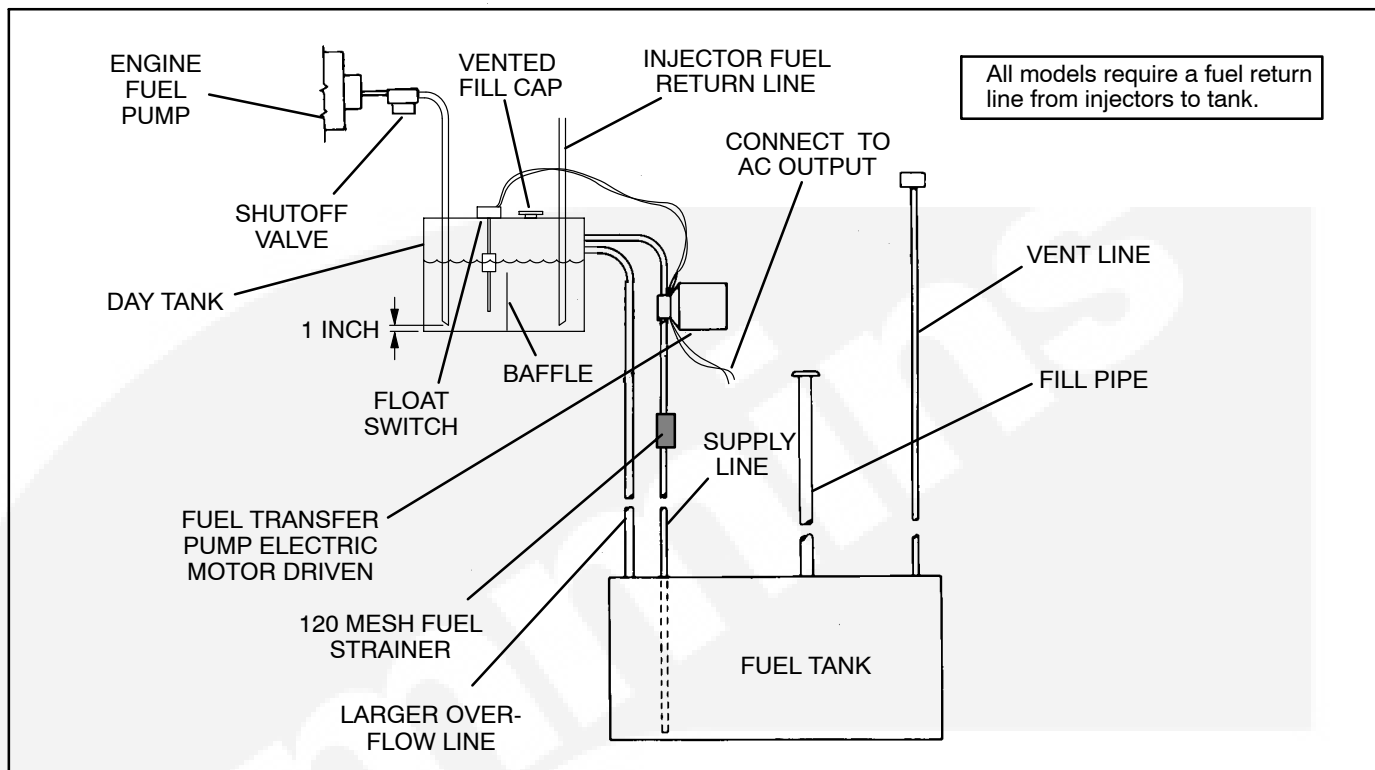
**⚠ WARNING** *Fuel leaks create fire and explosion hazards which can result in severe personal injury or death. Always use flexible tubing between engine and fuel supply and return to avoid line failure and leaks due to vibration. The fuel system must meet applicable codes.*

Installation of the fuel hose must be done according to all applicable codes and standards, and installation recommendations provided by the manufacturer. The supplied flexible hose is approved by the hose manufacture for use with the genset fuel type and product application.

Support fuel lines to restrain movement and prevent chaffing or contact with sharp edges, electrical wiring and hot exhaust parts.

**⚠ WARNING** *Sparks and hot surfaces can ignite fuel, leading to severe personal injury or death. Do not route fuel lines near electrical wiring or hot exhaust parts.*

Fuel lines must be routed and secured to maintain a 1/2 inch (12.7 mm) minimum clearance from electrical wiring and a 2 inch (51 mm) minimum clearance from hot exhaust parts.



**FIGURE 4-1. TYPICAL FUEL SUPPLY INSTALLATION**

## Engine Fuel Connections

Identification tags are attached to the fuel supply line and fuel return line connections.

## Supply Tank

Locate the fuel tank as close as possible to the generator set and within the restriction limitations of the fuel pump.

Install a fuel tank that has sufficient capacity to supply the genset operating continuously at full rated load for the planned period of operation or power outage. Refer to *Data Sheet* for fuel consumption data.

If the fuel inlet restriction exceeds the defined limit due to the distance/customer-supplied plumbing between the genset and the main fuel tank, a transfer tank (referred to as a day tank) and auxiliary

pump will also be required. If an overhead main fuel tank is installed, a transfer tank and float valve will be required to prevent fuel head pressures from being placed on the fuel system components.

**For critical start applications, where generator sets are paralleled or must satisfy emergency start-time requirements, it is recommended that a fuel tank or reservoir be located such that the lowest possible fuel level is not less than 6 inches (150 mm) above the fuel pump inlet. This will prevent air from accumulating in the fuel line while the set is in standby, eliminating the period during startup when it has to be purged.**

**Fuel Inlet Pressure/Restriction Limit:** Engine performance and fuel system durability will be compromised if the fuel inlet pressure or restriction limits are not adhered to. Fuel inlet pressure or restriction must not exceed the limits stated in the *Generator Set Data Sheet*.



## Day Tank (If Used)

Fuel day tanks are used when fuel inlet restriction limits can not be met, or the supply tank is overhead and presents problems of high fuel head pressure for the fuel inlet and return lines.

**Supply Tank Lower Than Engine:** With this installation, the day tank is installed near the generator set, below the fuel injection system and within the fuel inlet restriction limit. Install an auxiliary fuel pump, to pump fuel from the supply tank to the day tank. A float switch in the day tank controls operation of the auxiliary fuel pump.

**The supply tank top must be below the day tank top to prevent siphoning from the fuel supply to the day tank.**

Provide a return line from the engine injection system return connection to the day tank. Plumb the re-

turn line to the bottom of day tank as shown in Figure 4-1. Provide a day tank overflow line to the supply tank in case the float switch fails to shut off the fuel transfer pump.

**⚠ WARNING** *Spilled fuel presents the hazard of fire or explosion which can result in severe personal injury or death. Provide an overflow line to the supply tank from the day tank.*

**Supply Tank Higher Than Engine:** Install the day tank near the generator set, but below the fuel injection system. Use fuel line at least as large as the fuel pump inlet. The engine fuel return line must enter the day tank.

Include a shutoff valve in the fuel line between the fuel supply tank and the day tank to stop fuel flow when the generator set is off.

**⚠ WARNING** *Spilled fuel can create environmental hazards. Check local requirements for containment and prevention of draining to sewer and ground water.*

## EXHAUST SYSTEM

Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlets away from any air inlets to avoid gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation and light loads. Regularly inspect the exhaust system both visually and audibly to see that the entire system remains fume tight and safe for operation.

**⚠ WARNING** *Inhalation of exhaust gases can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Terminate exhaust pipe away from enclosed or sheltered areas, windows, doors and vents.*

For indoor installation, the exhaust system must use sealed joint type fittings, (for example NPT fittings) to provide a tighter exhaust system. Use of slip type fittings (secured with a muffler clamp) may allow leakage of exhaust gases into the building.

**⚠ WARNING** *Inhalation of exhaust gases can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Use NPT or equivalent type fittings for all indoor installations.*

Use an approved thimble (Figure 4-2) where exhaust pipes pass through wall or partitions. Insulated wall/roof thimbles are used where exhaust pipes pass through a combustible roof or wall. This includes structures, such as wood framing or insulated steel decking, etc. Uninsulated wall/roof thimbles are used where exhaust pipes pass through a non-combustible wall or roof, such as concrete. When a unit is provided with a partially installed or incomplete exhaust system, exhaust piping and chimneys shall be designed, constructed, and installed in accordance with the Standard for the Installation and Use of Stationary

Combustion Engines and Gas Turbines, NFPA 37 or applicable local standards, Section 6-3. Build according to the code requirements in effect at the installation site.

**⚠ WARNING** *Hot exhaust pipes can start a fire and cause severe injury or death if improperly routed through walls. Use an approved thimble where exhaust pipes pass through walls or partitions.*

**⚠ WARNING** *Inhalation of exhaust gases can result in severe personal injury or death. Do not use exhaust heat to warm a room, compartment or storage area.*

Rain caps are available for the discharge end of vertical exhaust pipes. The rain cap clamps onto the end of the pipe and opens due to exhaust discharge force from the generator set. When the generator set is stopped, the rain cap automatically closes, protecting the exhaust system from rain, snow, etc.

Use a section of flexible exhaust pipe between the engine and remainder of exhaust system. Support exhaust system to prevent weight from being applied to engine exhaust outlet elbow/turbocharger connection.

**⚠ CAUTION** *Weight applied to the engine manifold can result in turbocharger damage. Support the muffler and exhaust piping so no weight or stress is applied to engine exhaust elbow.*

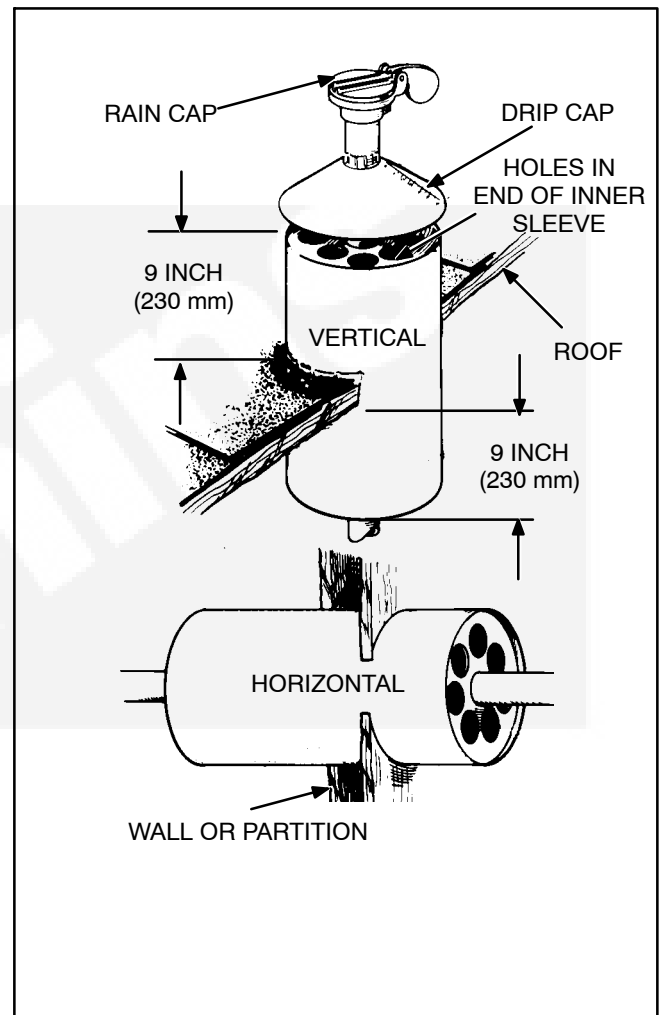
The exhaust system design should meet local code requirements.

**Liability for injury, death, damage, and warranty expense due to use of unapproved mufflers or modifications becomes the responsibility of the person installing the unapproved muffler or performing the modification. Contact a Cummins Power Generation distributor for approved exhaust system parts.**

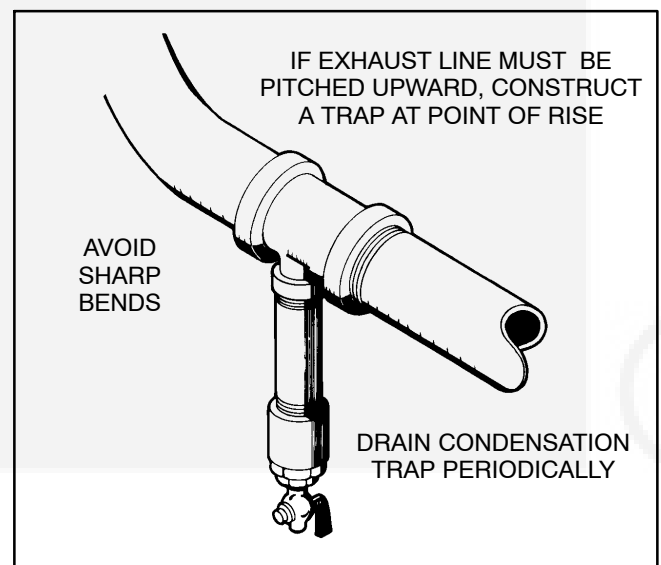
Avoid sharp bends by using sweeping, long radius elbows and provide adequate support for muffler and tailpipe. Pitch a horizontal run of exhaust pipe **DOWNWARD** (away from engine) to allow any moisture condensation to drain away from the engine. If an exhaust pipe must be turned upward, install a condensation trap at the point where the rise begins (Figure 4-3).

Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 12 inches (305 mm) of clearance if the pipes pass close to a combustible wall or partition. Before installing insulation on exhaust system components, check the exhaust system for leaks while operating the genset under full load and correct all leaks.

**⚠ WARNING** *Exhaust pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard. Shield or insulate exhaust pipes if there is danger of personal contact or when routed through walls or near other combustible materials.*



**FIGURE 4-2. MOUNTING EXHAUST THIMBLE**



**FIGURE 4-3. CONDENSATION TRAP**

## VENTILATION AND COOLING

Generator sets create considerable heat that must be removed by proper ventilation. Outdoor installations normally rely on natural air circulation but indoor installations need properly sized and positioned vents for required airflow.

### Vents and Ducts

For indoor installations, locate vents so incoming air passes through the immediate area of the installation before exhausting. Install the air outlet higher than the air inlet to allow for convection air movement.

Size the vents and ducts so they are large enough to allow the required flow rate of air. The "free area" of ducts must be as large as the exposed area of the radiator. Refer to the genset *Data Sheet* for the airflow requirements and allowed airflow restriction.

Wind will restrict free airflow if it blows directly into the air outlet vent. Locate the outlet vent so the effects of wind are eliminated. See Figure 4-4.

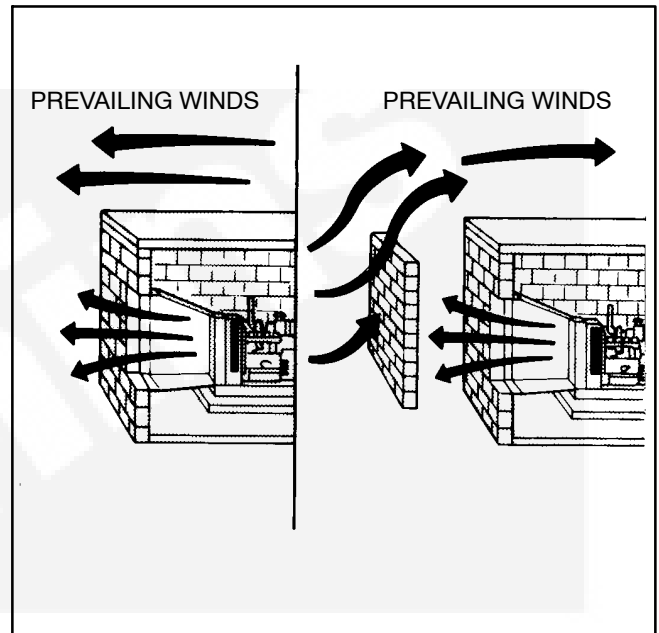


FIGURE 4-4. WIND BARRIER

## Dampers

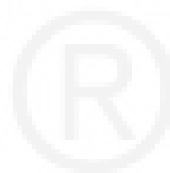
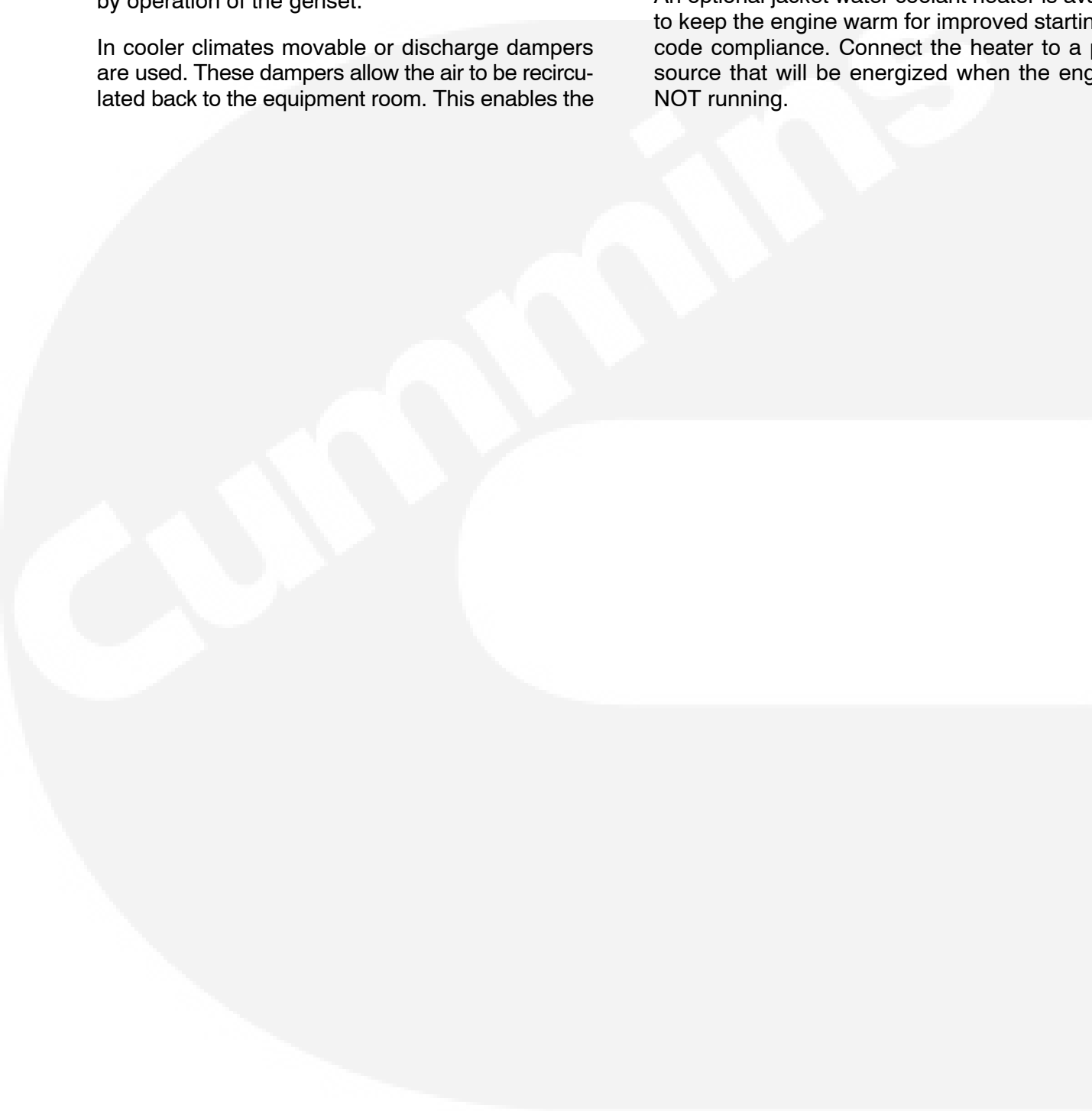
Dampers or louvres protect the genset and equipment room from the outside environment. Their operation of opening and closing should be controlled by operation of the genset.

In cooler climates movable or discharge dampers are used. These dampers allow the air to be recirculated back to the equipment room. This enables the

equipment room to be heated while the genset engine is still cold, increasing the engine efficiency.

## Engine Coolant Heater (Optional)

An optional jacket water coolant heater is available to keep the engine warm for improved starting and code compliance. Connect the heater to a power source that will be energized when the engine is NOT running.



## Radiator Cooling

**Radiator Set Requirements:** Radiator set cooling air is drawn past the control end of the set by pusher fans that blow air through the radiator (Figure 4-5). Locate the air inlet to the rear of the set. Make the inlet vent opening 1-1/2 to 2 times larger than the radiator area.

**Louvers and screens over air inlet and outlet openings restrict air flow and vary widely in performance. A louver assembly with narrow vanes, for example, tends to be more restrictive than one with wide**

**vanes. The effective open area specified by the louver or screen manufacturer should be used.**

Locate the cooling air outlet directly in front of the radiator and as close as possible. The outlet opening must be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to airflow.

Attach a canvas or sheet metal duct to the flange and the air outlet opening using screws and nuts so duct can be removed for maintenance purposes. The duct prevents circulation of heated air. Before installing the duct, remove the radiator core guard.

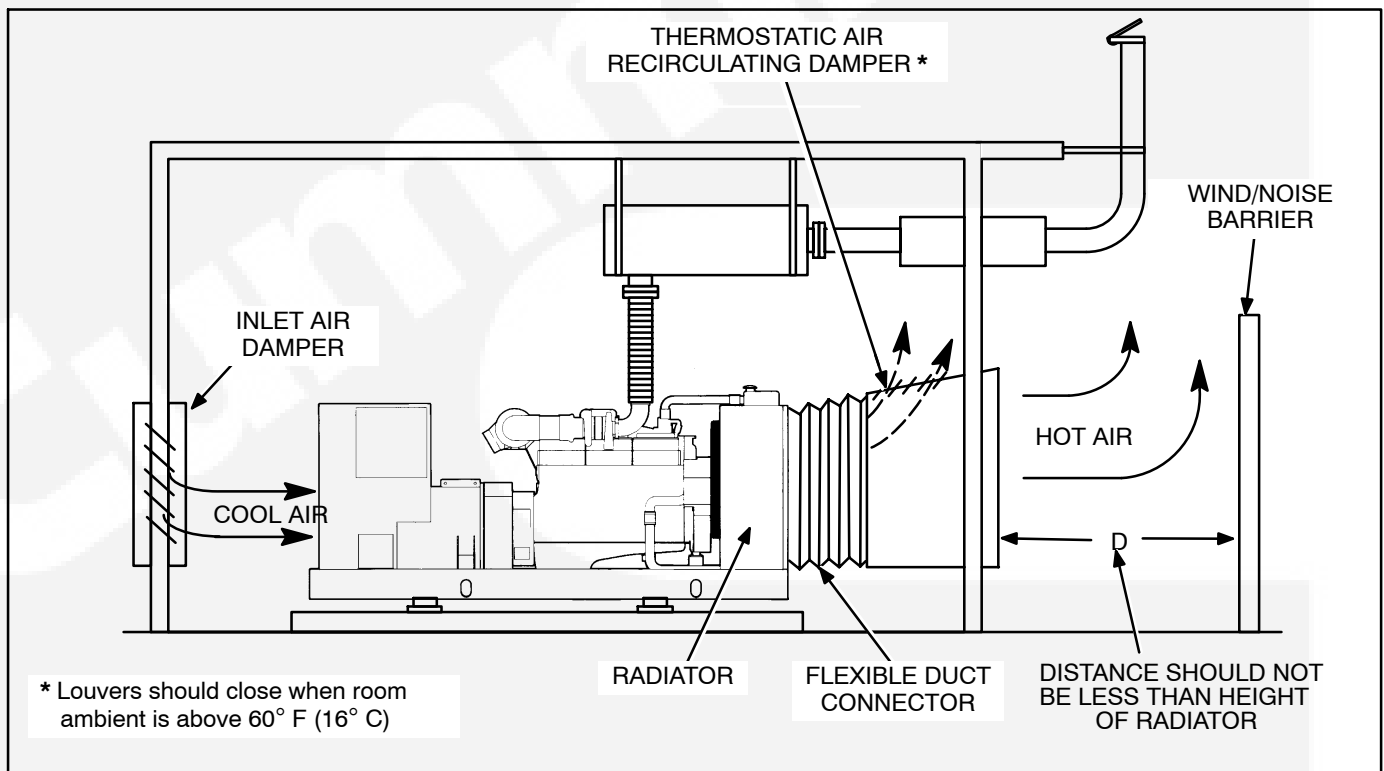


FIGURE 4-5. TYPICAL RADIATOR SET INSTALLATION

## Remote Radiator Cooling (Optional)

Remote radiator cooling substitutes a remote mounted radiator and an electrically driven fan in place of the set mounted components. Removal of the radiator and the fan from the set reduces noise levels without forcing dependence on a continuous cooling water supply (necessary with heat exchanger cooling). The remote radiator installation must be completely protected against freezing.

Remote radiator plumbing will vary with installation. Follow recommendations given in Application Manual T-030. See product *Data Sheet* for friction head and static head limits.

**Before filling cooling system, check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger or remote mounted radiator.**

## Heat Exchanger (Optional)

The optional heat exchanger (Figure 4-6) uses a shell and tube type heat exchanger instead of the standard radiator and fan. Engine jacket coolant circulates through the shell side of the heat exchanger while the cooling water is pumped through the tubes. Engine coolant and raw water do not mix.

This system may reduce set enclosure airflow requirements and noise levels. Proper operation depends on a constant supply of raw water for heat removal. Adjust the flow to maintain engine coolant temperature between 165° F and 195° F (74° C and 91° C) while viewing the water temperature gauge. The engine coolant side of the system can be protected from freezing; the raw water side cannot be protected.

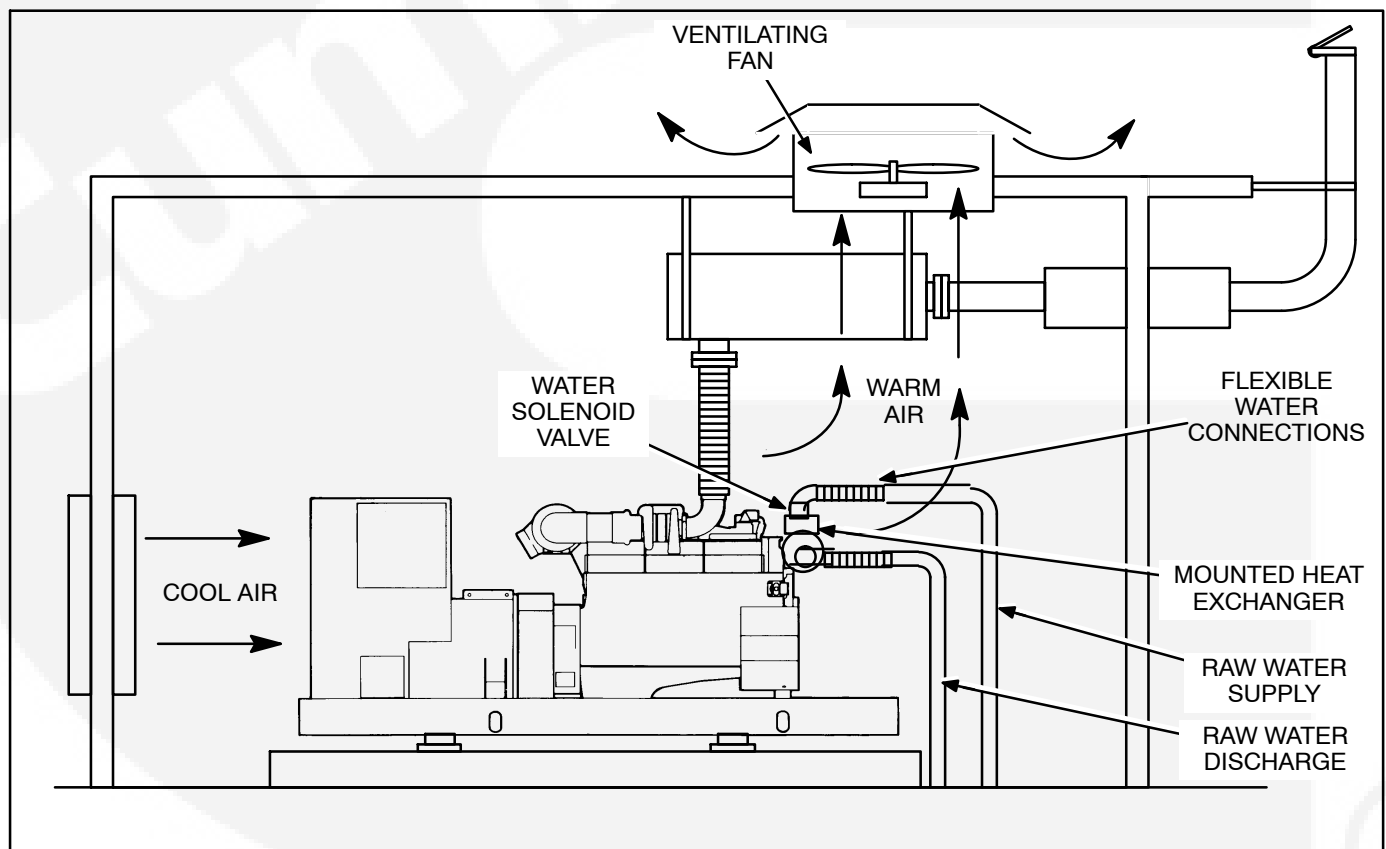


FIGURE 4-6. TYPICAL HEAT EXCHANGER INSTALLATION

## COOLANT

The cooling system of radiator type gensets can be shipped installed or as a separate item. If shipped with the cooling system installed, both radiators are filled with the proper fluids at the factory. Make sure that the coolant levels of both radiators are correct before starting.

The procedure for checking and filling the cooling system of a set mounted radiator is provided in Section 9 of this manual.

### Coolant Filters

Two spin-on type corrosion filters (Figure 4-7) are standard equipment. To prevent coolant loss during filter replacement, a coolant shut off valve is provided (Figure 4-7). Make sure shutoff valve is in the **ON** position before operating the generator set.

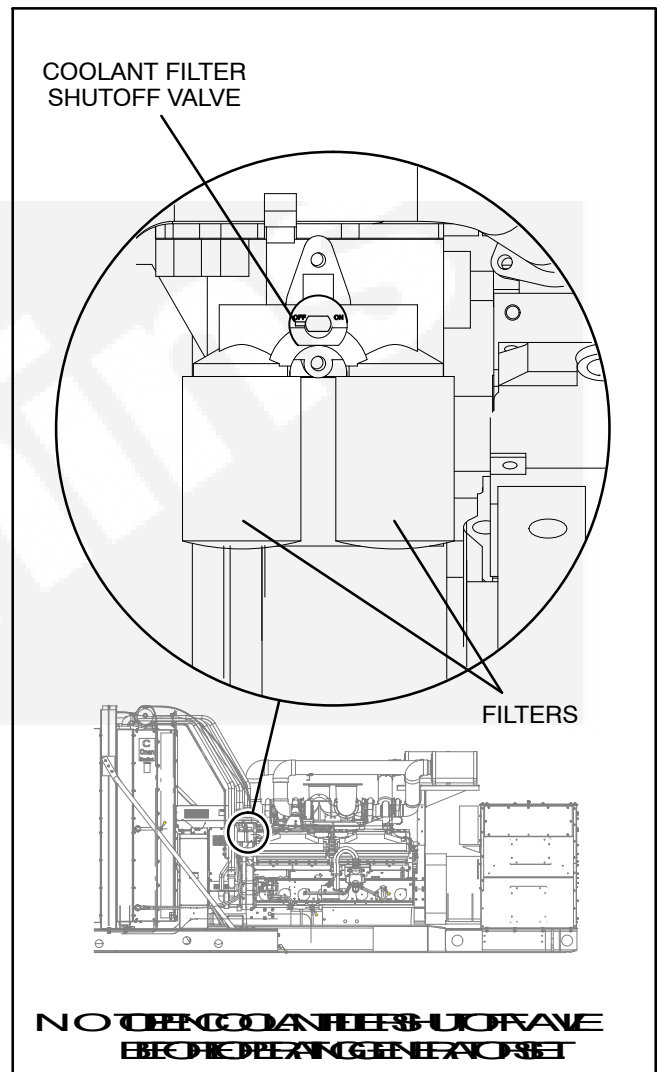


FIGURE 4-7. TYPICAL COOLANT FILTER



# 5. DC Control Wiring

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## CONTROL WIRING

The generator set electronics box, which is located on the backside of the control housing, contains connection points for remote control and monitor options. These connection points are located in two different locations within the electronics box as shown in Figure 5-1.

**⚠ CAUTION** *Do not attach conduit to the electronics box for any reason. All conduit must be attached to the control housing. Attaching conduit to the electronics box will compress the electronics box vibration isolators, causing the box to vibrate and damage the electronic circuitry.*

Use flexible conduit for all wiring connections to the generator set. All conduit used for control wiring must be attached to the control housing, not to the electronics box. Route the control wiring through the control housing and into the access hole on the back panel of the electronics box. Use cable ties to keep control wiring away from sharp edges and AC power cables within control housing.

**⚠ CAUTION** *Stranded copper wire must be used for all customer connections to the electronics box. Solid copper wire may break due to genset vibration.*

## REMOTE MONITOR/CONTROL CONNECTIONS

Customer monitor/control connections are attached to terminal blocks TB3, TB4 TB5 and TB8. Optional equipment such as a remote annunciator panel, sensing devices used to monitor genset operation, remote start/stop switches, control box heater, and etc. are attached to these terminal blocks. Driver signals for customer supplied relays are also provided for several alarm and shut down conditions. Refer to Customer Connections diagram in Section 10.

**⚠ CAUTION** *When removing terminal block connectors (TB4, TB5, or TB8) from cards in card cage, note orientation of connector. These terminal block connectors are not keyed and can be installed incorrectly, which will cause control failures.*

## Terminal Block Wiring

**⚠ CAUTION** *Always run control circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.*

**Digital Connections:** Connection points, other than relayed outputs, network, switched B+ and B+ are considered digital connections to the terminal blocks. The type/gauge wire to use for these connections are:

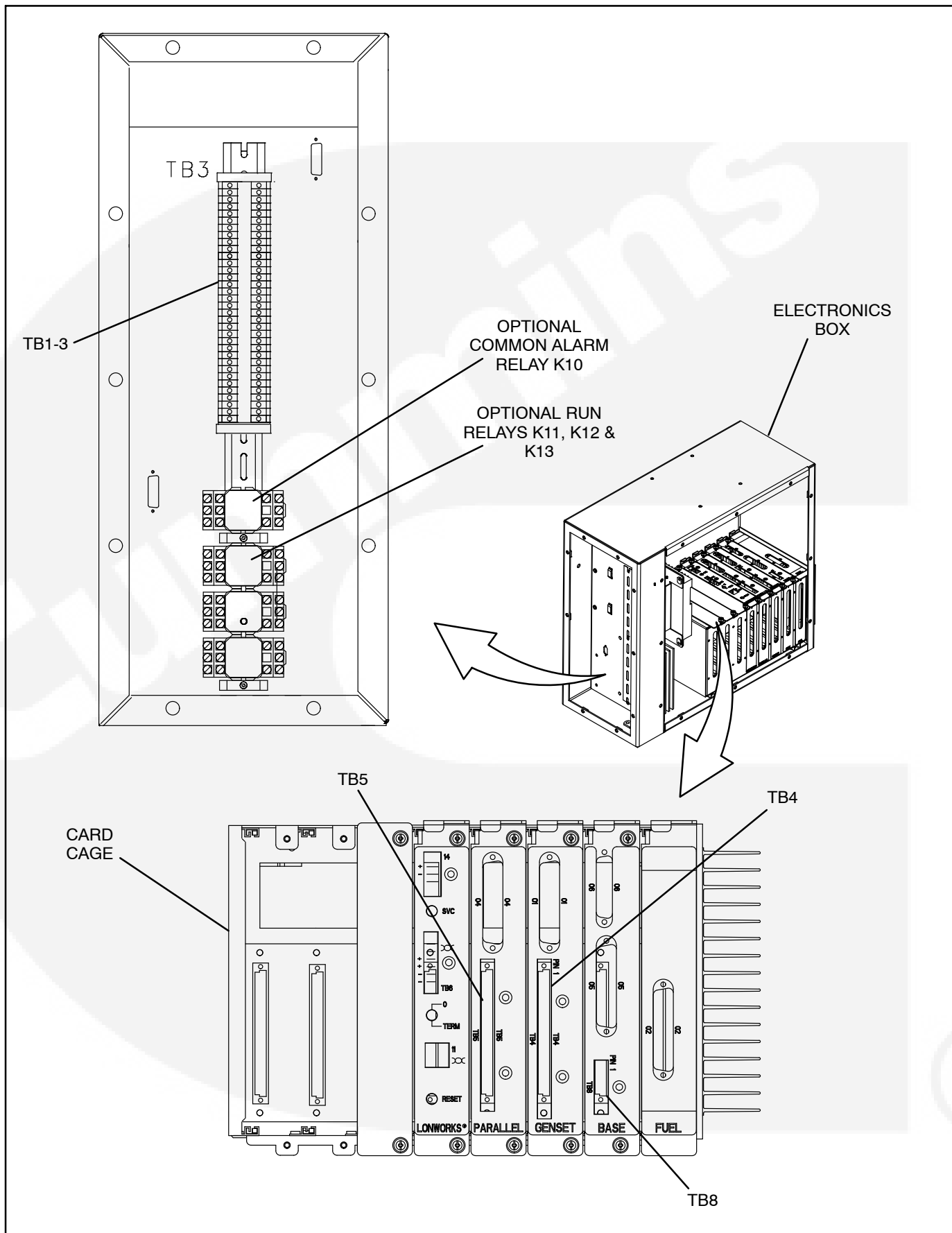
- Less than 1000 feet (305m), use 20 gauge stranded copper wire.
- 1000 to 2000 feet (305 to 610m), use 18 gauge stranded copper wire.

**Relay Connections:** Due to the wide variety of devices that can be attached to the relay outputs of terminal blocks, the electrical contractor must determine the gauge of the **stranded copper** wire that is used at this installation site. Refer to Customer Connections diagram in Section 10 for the relay specifications.

**Switched B+:** (Fused at 20 amps.) Same as Relay Connection description.

**B+:** (Fused at 20 amps.) Same as Relay Connection description.

**Network Connections:** Refer to 900-0366 *Power-Command Network Installation and Operation* manual for the type/gauge wire to use for these connections.



**FIGURE 5-1. ELECTRONICS BOX**

## RUN RELAYS (K11, K12, K13)

The optional run relays are rail mounted inside the electronics box (Figure 5-1). The rail mount allows you to easily remove and replace the snap-on relays. The generator set can be equipped with one, two or three run relays.

The three-pole, double-throw run relays (Figure 5-2) are used to control auxiliary equipment such as

fans, pumps and motorized air dampers. The run relays are energized when the generator set reaches operating speed.

The contacts are rated:

- 10 amps at 28 VDC or 120 VAC, 80%PF
- 6 amps at 240 VAC, 80%PF
- 3 amps at 480/600 VAC, 80%PF

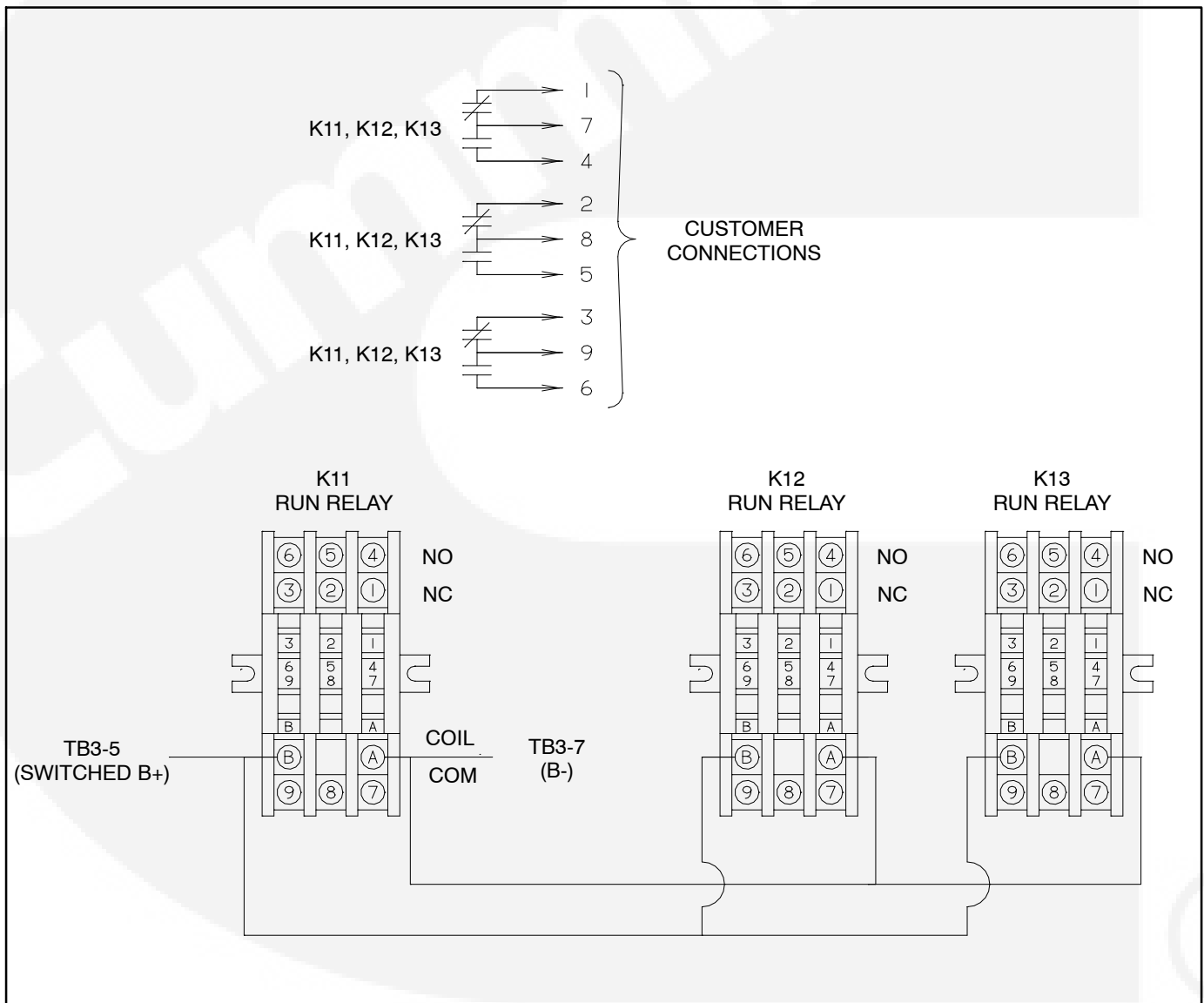


FIGURE 5-2. OPTIONAL RUN RELAYS (K11, K12, K13)

## ALARM RELAY (K10)

The optional alarm relay is rail mounted inside the electronics box (Figure 5-1). The rail mount allows you to easily remove and replace the snap-on relay.

The three-pole, double-throw alarm relay (Figure 5-3) is often used to energize warning devices such

as audible alarms. Any generator set warning or shutdown will energize the alarm relay.

The contacts are rated:

- 10 amps at 28 VDC or 120 VAC, 80%PF
- 6 amps at 240 VAC, 80%PF
- 3 amps at 480/600 VAC, 80%PF

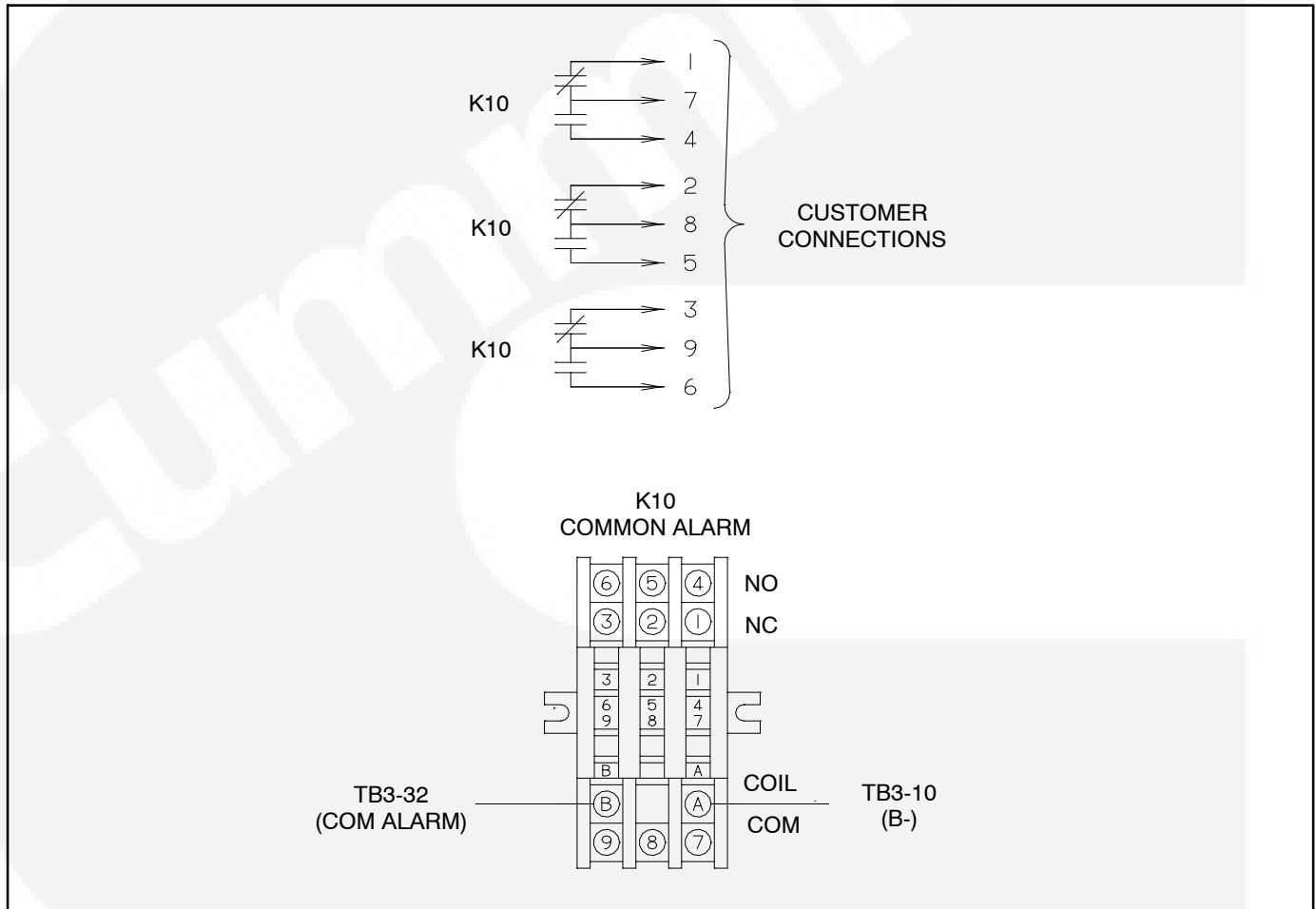


FIGURE 5-3. OPTIONAL ALARM RELAY (K10)

# 6. AC Electrical Connections

## GENERAL

This section provides the procedure that is used to connect the AC electrical system of the genset.

Before making any AC electrical connections, make certain the generator set cannot be accidentally started. Move the O/Manual/Auto switch on the control panel to the O (off) position. Turn off or remove AC power from the battery charger and then remove the negative (-) battery cable from the set starting battery.

**⚠WARNING** *Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.*

*Ventilate battery area before working on or near battery—Wear goggles—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (-) cable first and reconnect last.*

**⚠CAUTION** *Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the set.*

**⚠WARNING** *Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.*

**⚠WARNING** *Each of the operations described in this section should be done only by persons trained and experienced in electrical maintenance. Improper procedures may result in property damage, bodily injury or death.*

Connecting the genset AC electrical system involves:

- Generator insulation check
- Installation of transfer switch
- Generator output voltage selection
- Load cable connection
- Standard and optional AC equipment connections (e.g., control box heater, coolant heater, etc.

Local regulations often require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire sizes, materials used, etc. must conform to the requirements of electrical codes in effect at the installation site.

**⚠WARNING** *Improper wiring can cause a fire or electrocution, resulting in severe personal injury or death and/or property and equipment damage.*

Before starting the genset, check to make sure that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the genset are properly connected.

**⚠WARNING** *Backfeed to utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after building main switch is opened.*

## INSULATION RESISTANCE (MEGGER) & POLARIZATION INDEX (PI) TESTING

Megger and PI testing **must** be performed on all medium voltage (601 through 15,000 volts) generator sets before initial start-up. PI testing for low voltage (less than 600 volts) generator sets is recommended by Cummins Power Generation.

These tests are used to verify that the windings are dry before the generator set is operated and develop a base line for future test comparisons.

Before these tests can be performed on medium voltage generator sets, you must first perform the generator grounding procedure.

### Generator Set Grounding Procedure

Prior to performing service or inspection procedures that may expose personnel to conductors normally energized with voltages greater than 600 volts, the following generator set grounding procedure must be followed.

**⚠ DANGER** *Do not perform these procedures unless fully trained in medium voltage grounding procedures and have necessary safety equipment. Severe injury or death due to high voltage electrical shock may result.*

1. Open, lock-out and tag-out all sources of power to the immediate work area.
2. Disable the starting system of the generator set:
  - a. Disconnect the battery charger from its AC source.
  - b. Remove the negative battery cable from the battery.
  - c. Install a lockout device on the battery cable end. (For engines equipped with an air-powered starting system, close air valve and install valve locking device.)

3. Put on high voltage gloves with leather protectors.
4. Using two pre-tested voltage detection devices (of the proper rating), verify de-energized condition in the work area. (Retest voltage detection devices immediately after verification of de-energized condition.)
5. Remove the metal cover from the generator output box to gain access to generator load terminals.
6. Securely install the Grounding Cluster ground clamp to a verified “grounded” conductor.

**⚠ WARNING** *Hazardous voltage. Can cause severe personal injury or death. After DC voltage from the test equipment has been applied to the windings and ground, there will be a definite static charge on the windings. Reconnect Grounding Cluster to remove static charge from the winding after each generator test.*

7. With the Grounding Cluster in place, you are protected from all static and/or induced charges that may have been present in the generator stator.

Leave grounds connected for one minute to insure static charge dissipation. Remove ground cluster and perform PI and/or any other tests required on the stator winding. Reconnect grounds if additional generator service is necessary.
8. When work on the generator set is complete, remove the Grounding Cluster in the reverse order of installation.
9. After getting clearance from all personnel involved in the lock-out/tag-out procedure, remove all lock-out devices in reverse order of installation.

## Megger and PI Test

**⚠ DANGER** *Medium-voltage, 601 to 15,000 volts, present special hazards of severe personal injury or death. Even after genset shutdown, an electrical shock hazard may still exist, caused by induced voltage within the generator or cables. Service personnel must be well-trained/qualified to work with distribution voltages. (See Generator Set Grounding Procedures, Page 6-2.)*

**⚠ WARNING** *Windings of medium voltage (601 through 15,000 volts) generator sets must be dry before the generator is operated. Failure to ensure dry windings before start-up may result in catastrophic failure, severe personal injury and death.*

**Megger Test:** The megger test consists of applying voltage for up to one minute. The highest resistance values shown in Table 6-1 should be obtained for a new generator with dry windings. For a set that has been in service, the resistance reading should not be less than the lower value shown.

**PI Test:** The PI test consists of applying a voltage between the winding and ground for ten minutes and recording resistance values at one minute and at ten minutes. The PI is the ratio of a ten minute reading in megohms divided by a one minute reading in megohms. A ratio of two or greater is considered good for new and in-service sets.

If low readings are obtained, investigate the cause and correct before the generator set is returned to service. If moisture is determined to be the cause of low test readings, a winding drying process will be required (refer to genset *Service* manual for drying procedure).

1. Perform the *Generator Set Grounding Procedure* in this section.

**⚠ CAUTION** *When megger testing a generator, failure to protect the voltage regulator, control and diodes could result in permanent damage to one or more of the electronic components.*

2. Disconnect connector **10** from the voltage regulator output stage module and the AC control input leads from the generator output terminals. The AC control leads are marked 5, 6, 7 and 8. Refer to the reconnection diagram, which is located on the upper side cover of the control housing.
3. If the RTD (resistive thermal device) option is installed, ground all six resistive thermal device temperature leads. Each RTD has three leads, one red and two white leads. Total of 18 leads must be grounded.

### Main Stator:

4. Disconnect the main rotor and voltage suppressor leads from terminals **F1+** and **F2-** on the rotating rectifier assemblies and isolate them from ground. Tag and mark each lead with its terminal number (**F1+** or **F2-**).
5. Remove and separate the neutral leads of the generator from the generator load terminal marked "N".
6. Connect the megger between one phase of the stator and ground while grounding the other two phases and conduct the test. Refer to Table 6-1 for megger voltage selection and required resistance values.

Repeat this step in turn for the other two phases.

### Main Rotor:

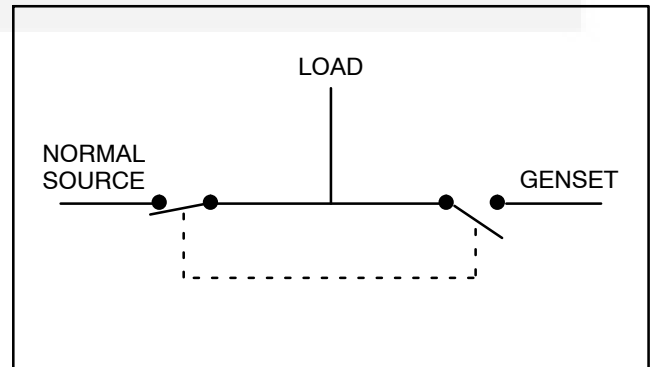
7. Disconnect the main rotor and voltage suppressor leads from terminals **F1+** and **F2-** on the rotating rectifier assemblies and isolate them from ground. Tag and mark each lead with its terminal number (**F1+** or **F2-**).
8. Connect the megger between one of the rotor leads and ground and conduct the test. Refer to Table 6-1 for megger voltage selection and required resistance values.

**TABLE 6-1. GENERATOR INSULATION RESISTANCE**

GENERATOR VOLTAGE	MEGGER VDC SETTING	MINIMUM RESISTANCE (MEG)	
		MAIN STATOR	MAIN ROTOR
600 VAC or less	500	5.0 – 1.0	5.0 – 1.0
601 thru 5000 VAC	2500	400 – 50	
	1000		5.0 – 1.0
5001 thru 15000 VAC	5000	1000 – 200	
	1000		5.0 – 1.0

### TRANSFER SWITCH

If the installation is for standby service, a transfer switch must be used for switching the load from the normal power source to the genset (see Figure 6-1). Either a manual or automatic transfer switch may be used. Follow the installation instructions provided with the transfer switch when connecting the load and control wiring.

**FIGURE 6-1. TYPICAL LOAD TRANSFER FUNCTION**



## AC WIRING

### Generator Voltage Connections

The generator output voltage and maximum current rating are specified on the generator set nameplate. Line-to-neutral voltage is always the lower voltage shown and line-to-line voltage is the higher rating.

The generators are available at the voltages shown in the Wiring Diagram located on the upper side cover of the control housing. The generator is connected at the factory to produce a specified voltage per customer order (they cannot be reconfigured for different voltages in the field). Before shipping, the factory tests the generator set at the specified voltage.

### Load Connections

Flexible conduit and stranded conductors must be used for connections to take up movement of the generator set.

All loads are connected to the generator by bolting the **stranded** load wires to the appropriate terminals on the generator reconnection terminal block. The terminals are stamped U, V, W and N to indicate the line and neutral connections. (Reference: U, V, and W correspond with L1, L2 and L3; and N with L0 respectively).

### Load Balancing

When connecting loads to the generator set, balance the loads so the current flow from each line terminal (L1, L2 and L3) is about the same. This is especially important if both single phase and three phase loads are connected. Any combination of single phase and three phase loading can be used as long as each line current is about the same, within 10 percent of median value and no line current exceeds the nameplate rating of the generator. Check the current flow from each line after connections by observing the control panel ammeter.

## Grounding

The following is a brief description of system and equipment grounding of permanently installed AC generators within a facility wiring system. It is important to follow the requirements of the local electrical code.

Figure 6-2 illustrates typical system grounding for a 3-pole and a 4-pole automatic transfer switch (ATS). In the 3-pole ATS, note that the generator neutral is connected to the ATS and is NOT bonded to ground at the generator. In the 4-pole ATS system, a grounding electrode conductor and a bonding jumper are used to connect the generator neutral to ground.

Make sure the genset is grounded to earth in one location only. On generators without a circuit breaker, ground to the point indicated on the top of the generator. On gensets with circuit breakers, use the ground lug provided in the circuit breaker box.

**⚠ WARNING** *Electric current can cause severe personal injury or death. Bonding and grounding must be done properly. All metallic parts that could become energized under abnormal conditions must be properly grounded.*

Typical requirements for bonding and grounding are given in the National Electrical Code, Article 250. All connections, wire sizes, etc. must conform to the requirements of the electrical codes in effect at the installation site.

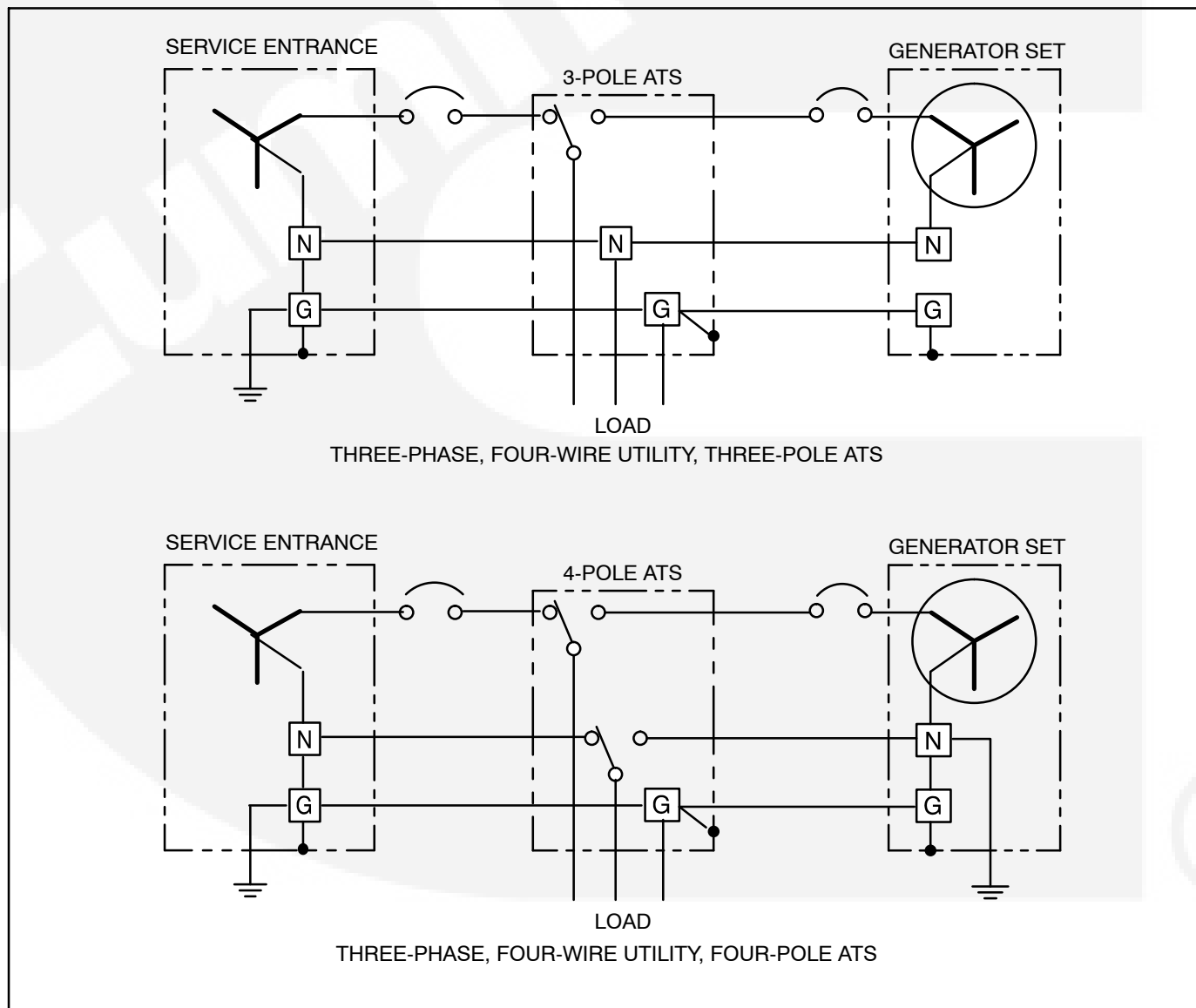
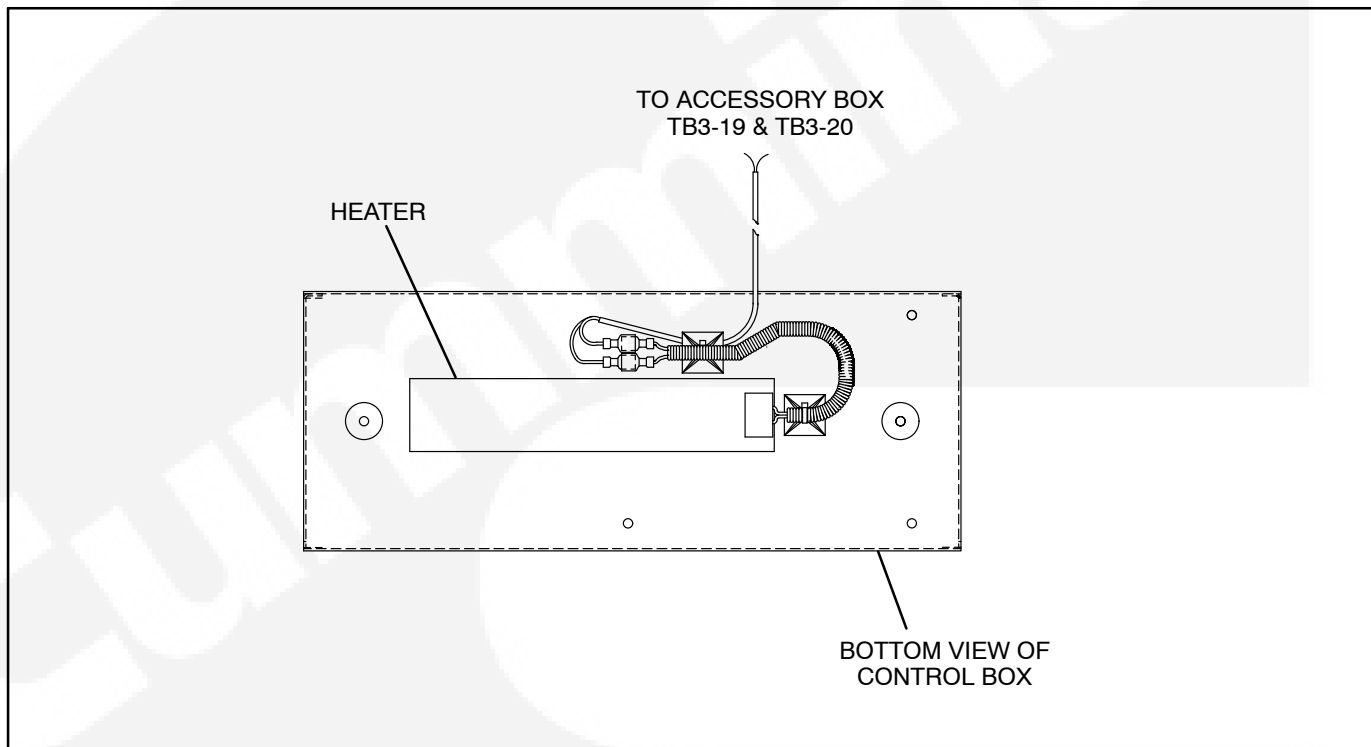


FIGURE 6-2. TYPICAL SYSTEM GROUNDING ONE-LINE DIAGRAMS

### CONTROL HEATER (OPTIONAL)

A control heater (Figure 6-3) provides a means of humidity /temperature control of the control box in-

terior. It protects the components when the generator set is subjected to varying ambient air conditions during extended periods of non-use.



**FIGURE 6-3. OPTIONAL CONTROL HEATER**

## COOLANT HEATER

Coolant heaters keep the engine coolant warm when the engine is shut down. It heats and circulates the coolant within the engine. This reduces startup time and lessens engine wear caused by cold starts. It is electrically operated and thermostatically controlled.

**⚠ CAUTION** *The coolant heater must not be operated while the cooling system is empty or when the engine is running or damage to the heater will occur.*

Figure 6-4 shows a typical coolant heater. Connect the heater to a source of power that will be on during

the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater element rating.

**A battery charger is required to prevent battery discharge. The heater control relay draws 83 mA of current when the heater(s) is off. The heater is off when the engine has reached the proper temperature or the engine is running.**

**⚠ CAUTION** *Do not connect AC power to the heater before connecting battery cables. Heater will run continuously without DC power and can overheat and damage heater.*

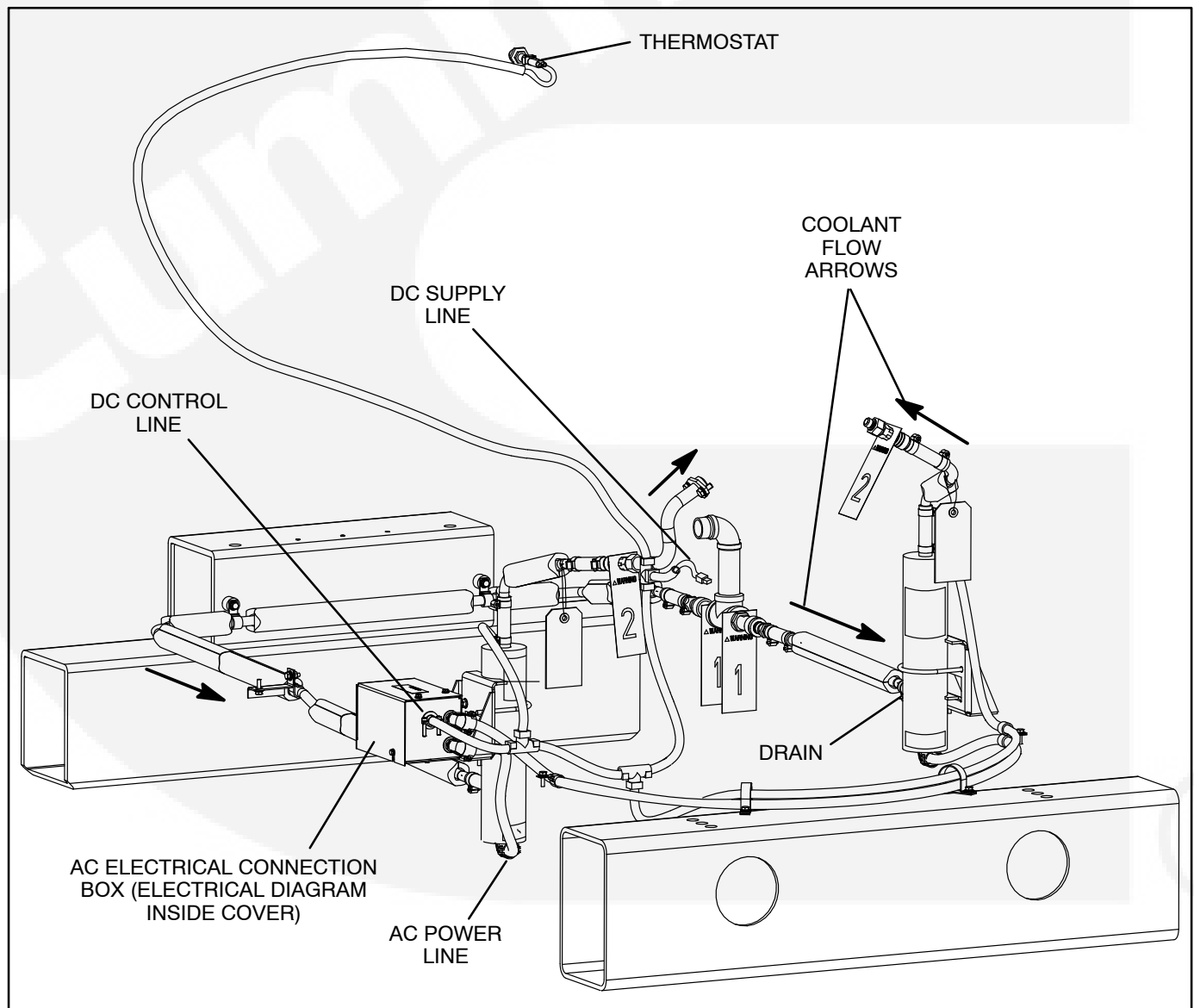


FIGURE 6-4. TYPICAL COOLANT HEATER

## GENERATOR HEATER

A generator heater(s) is used to help keep the generator free of condensation when the generator set is not running. During cool and humid conditions, condensation can form within a generator, creating flashing and a shock hazard.

**⚠ WARNING** *Water or moisture inside a generator increases the possibility of flashing and electrical shock, which can cause equipment damage and severe personal injury or death. Do not use a generator which is not dry inside and out.*

Figure 6-5 illustrates the installation of two heater elements. Connect the heater(s) terminals to a source of power that will be on during the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater element rating.

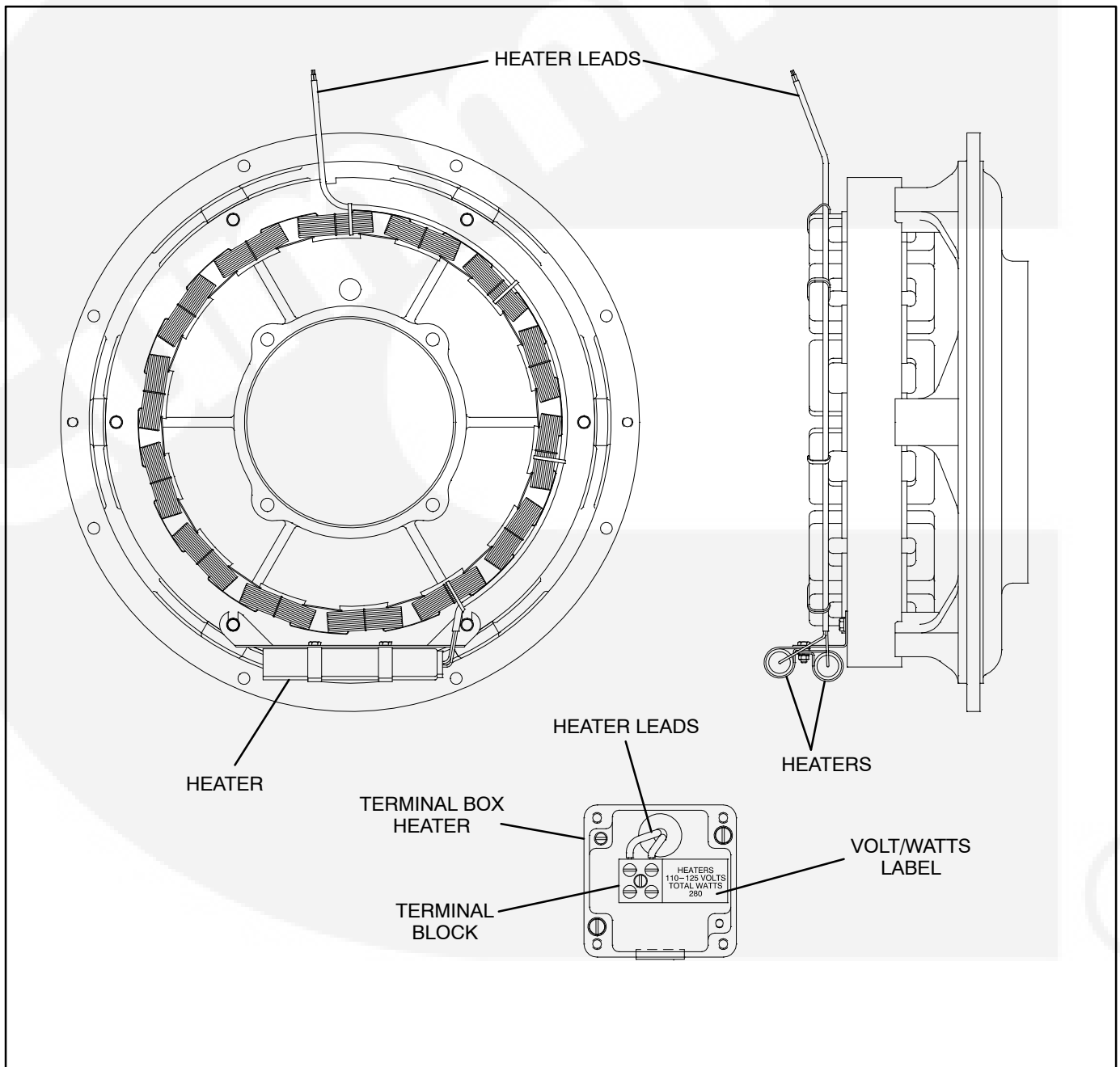


FIGURE 6-5. TYPICAL GENERATOR HEATER INSTALLATION

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# 7. Prestart Preparation

## GENERAL

Before attempting the initial start of the generator set, be sure to complete the *Installation Checklist* in *Section 8*.

## ELECTRICAL SYSTEM

Make sure all electrical connections are secure and all wiring is complete and inspected. Replace and secure any access panels that may have been removed during installation.

### Battery Connections

**⚠️WARNING** *Accidental starting of the generator set can cause severe personal injury or death. Make sure that the Run/Off/Auto switch on the control panel is set to the Off position before connecting the battery cables.*

Starting the unit requires 24 volt battery current, using four, 12 volt batteries (see *Specification* section). Connect the batteries in series (negative post of first battery to the positive post of the second battery) as shown in Figure 7-1.

Necessary battery cables are on the unit. Service batteries as necessary. Infrequent use (as in emergency standby service), may allow battery to self-discharge to the point where it cannot start the unit. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Cummins Power Generation automatic transfer switches include such a battery charging circuit.

**⚠️WARNING** *Ignition of explosive battery gases can cause severe personal injury or death. Always connect negative (-) battery cable last to prevent arcing.*

**⚠️WARNING** *Ventilate battery area before working on or near battery. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.*

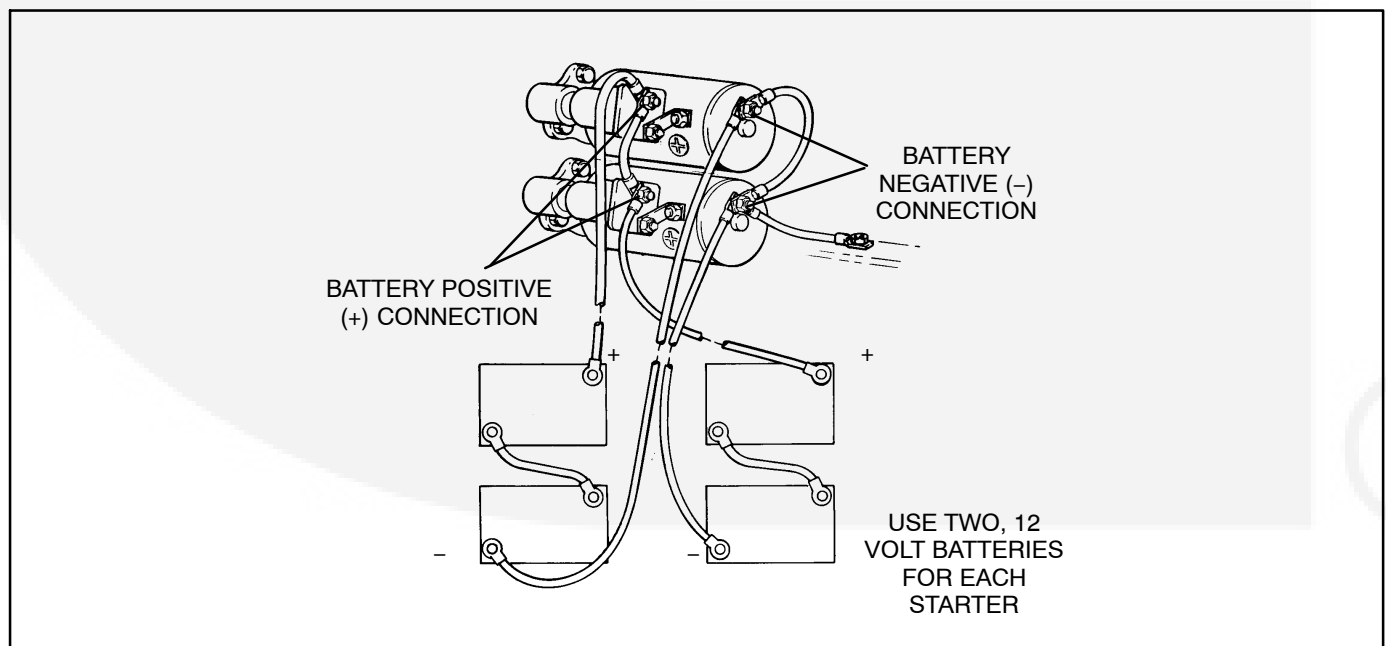


FIGURE 7-1. GENSET BATTERY CONNECTIONS

## CONTROL PRESTART CHECKS

All generator set configuration options are set at the factory except for site related options, (e.g., Start/Stop Delays, Cycle Crank, Customer Fault names, etc.).

Adjustments of these options are divided into two categories within the menu driven system. These two categories are Setup and Adjust.

The Setup submenus are intended for qualified service personnel only. The Adjust submenu is intended for qualified service and site personnel only.

For this reason, a separate password is required to modify the Setup submenus. The Adjust submenu may or may not require a password (site dependent).

The following procedure describes how to modify the Adjust submenu options that are required to complete the genset installation.

The Adjust submenu allows you to calibrate the generator set voltage/frequency and start/stop time delays. For the prestart checks, adjustment of only the start/stop delays is required.





ADJUST Submenu

Figure 7-2 shows the main menus (Menu A and Menu B) of the system control and the Adjust submenu.

To display the Adjust submenu, press the **MORE>>** button in Menu A and then the **ADJUST** button in Menu B.

The Adjust procedure is intended for qualified service personnel and site personnel only and may require a **USER** password. If a password is required, the **USER** password menu will appear when you try to modify the Adjust submenu. (Refer to *PASS-WORD Menu* in this section to enter password.

Changes are automatically saved when you exit this menu.

Use the **+** and **-** buttons to increase or decrease the values in the following fields. Use the arrow (**→**) button to move the cursor within a field or to the next field. Selected field is highlighted.

**START DELAY:** This delay applies only to remote starting in the Auto mode. The Start Delay adjustment range is 0 to 300 seconds.

**STOP DELAY:** This delay applies only to remote stopping in the Auto mode. The Stop Delay adjustment range is 0 to 600 seconds.

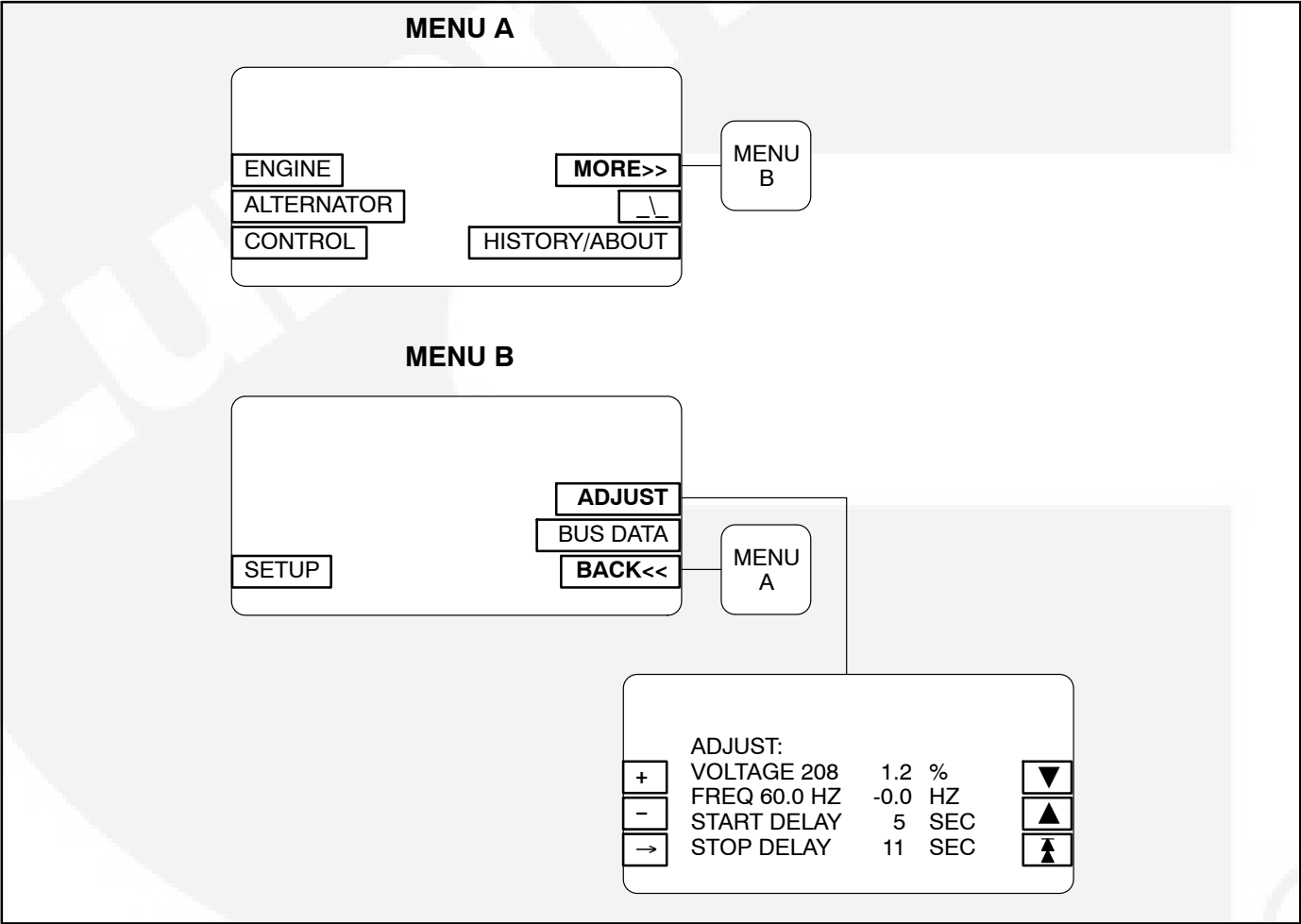


FIGURE 7-2. ADJUST SUBMENU

## PASSWORD Menu

When viewing the Adjust submenu, pressing either the + or – button will display the Password menu (Figure 7-3) if a **User** password is assigned to this field. After entering the correct password, the system will allow you to modify the submenu. To prevent unauthorized adjustment, the entered password is valid for only 10 minutes after the last button is pressed.

To enter the password:

1. Display Adjust submenu.
2. Press either the + or – button within the displayed submenu. The Password menu appears. (Adjustment is allowed if Password menu does not appear.)
3. Press the + and – button to select the first character of the **User** password.
4. Press the → button to select the next character field.
5. Repeat steps 3 and 4 to enter remaining password characters.
6. Press the **Enter** button after entering the password. The Adjust submenu will reappear.
7. Exit Adjust submenu to save changes.

### STARTING

Refer to the generator set *Operator's* manual for important safety precautions and recommended procedures for starting the genset and verifying proper operation. Start the generator set and verify all engine and generator gauges are displaying the correct values.

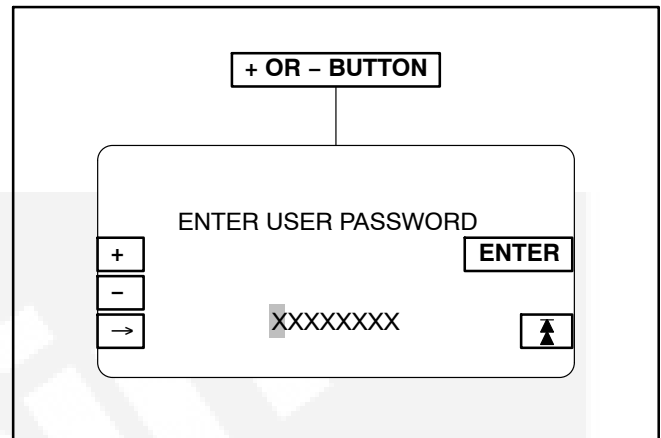


FIGURE 7-3. PASSWORD MENU



## 8. Installation Checklist

---

### GENERAL

- ☐ Generator set wattage capacity is sufficient to handle maximum anticipated load.
- ☐ At least 3 feet of clearance (or greater for housing door) is provided around entire generator set for servicing and ventilation.
- ☐ Generator set is located in an area not subject to flooding.
- ☐ All operating personnel have read and are familiar with Operator's Manual.
- ☐ All operators have been thoroughly briefed on preventive maintenance procedures.
- ☐ All operators have read and understand all Important Safety Instructions in Operator's Manual.

### GENERATOR SET SUPPORT

- ☐ Floor, roof or earth on which the generator set rests is strong enough and will not allow shifting or movement. Observe local codes on soil bearing capacity due to freezing and thawing.
- ☐ Generator set is properly supported and retained to approved base.
- ☐ Supporting base is large enough and is of non-combustible material – extends 6-inches all around set.

### COOLING AIR FLOW

- ☐ Generator set air inlet is faced into direction of strongest, prevailing winds.
- ☐ Air inlet openings are unrestricted and at least 1–1/2 times larger than air outlet area.
- ☐ Cooling air outlet is on downwind side of building (if not, wind barrier is constructed).
- ☐ Proper ducting material (sheet metal, canvas) is used between radiator and air outlet.

### DIESEL FUEL SYSTEM

- ☐ Fuel tanks meet or exceed all Local, State or National codes.
- ☐ Fuel lines are properly installed, supported and protected against damage.
- ☐ Approved flexible fuel line is installed between main fuel supply line and generator set's fuel system, near the generator set, to protect the fuel system from damage caused by vibration, expansion and contraction.
- ☐ Strainer or fuel screen (100 to 120 mesh) is installed in the fuel supply line to protect the fuel lift pump, day tank transfer pump or float valve seat from fuel supply tank debris.
- ☐ Fuel supply line shutoff valves are installed to prevent fuel flow in case of leaks.
- ☐ No shutoff valves are installed on engine fuel return line.
- ☐ External fuel pumps are connected and operational at all times (generator set started or shut down).
- ☐ Fuel system is properly primed.
- ☐ No fuel leaks are found in supply line or engine fuel system.

## **EXHAUST SYSTEM**

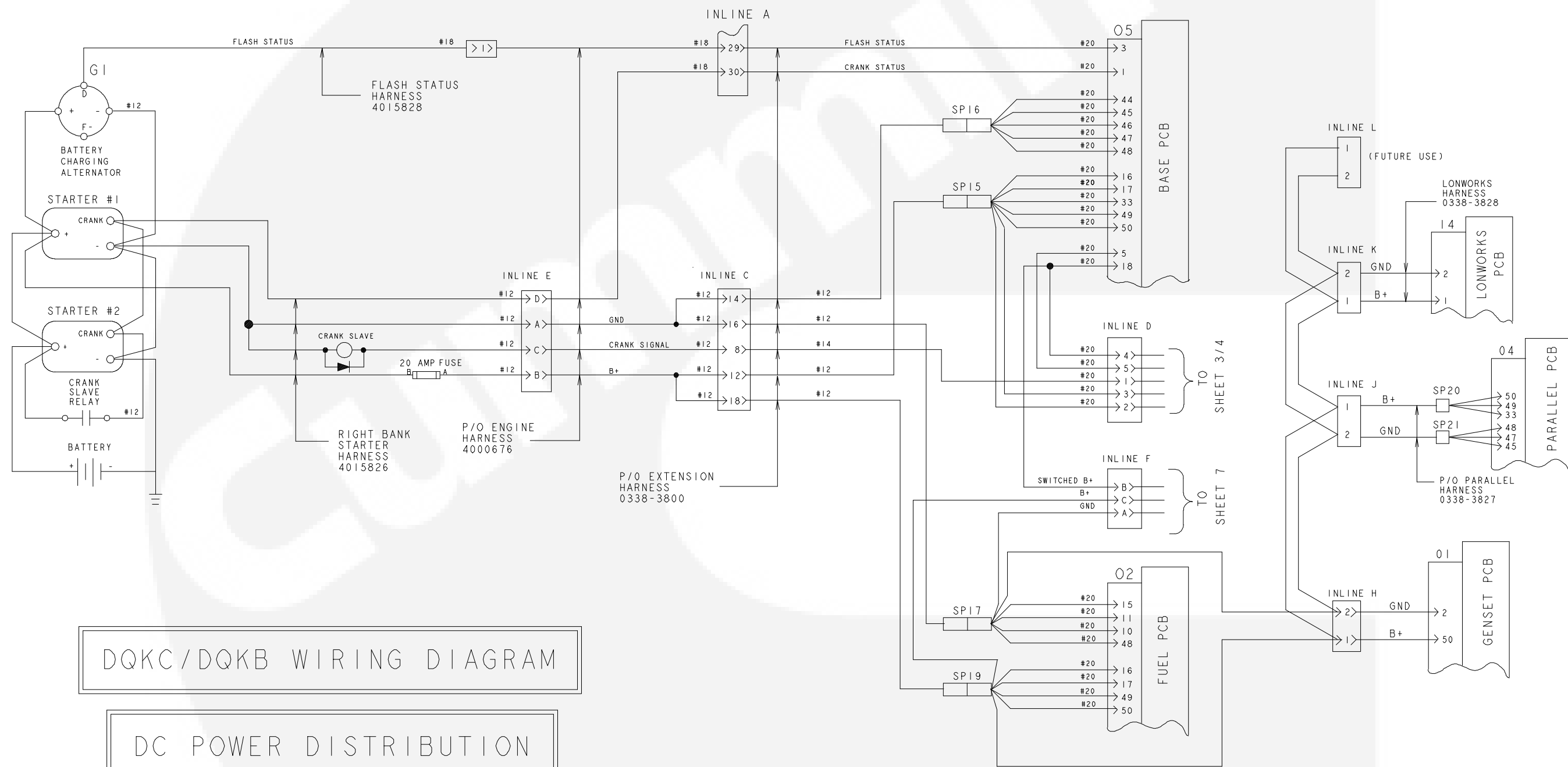
- ☐ Operators are thoroughly briefed on the dangers of carbon monoxide gas.
- ☐ Areas around set are well ventilated. No possibility of exhaust fumes entering building doors, windows, or intake fans.
- ☐ Exhaust gases are piped safely outside and away from building.
- ☐ The correct length of approved rigid pipe is connected to the generator set flexible pipe using approved securing methods with no weight resting on engine exhaust components. There are no bends in flex section.
- ☐ Condensation drain is provided in lowest section of exhaust piping.
- ☐ Exhaust piping is insulated to guard against burns to personnel.
- ☐ Exhaust piping passing through walls or ceilings have approved fire-proof materials and are in compliance with all codes.
- ☐ Exhaust piping is large enough in diameter to prevent excessive back pressure on engine.

## **AC AND DC WIRING**

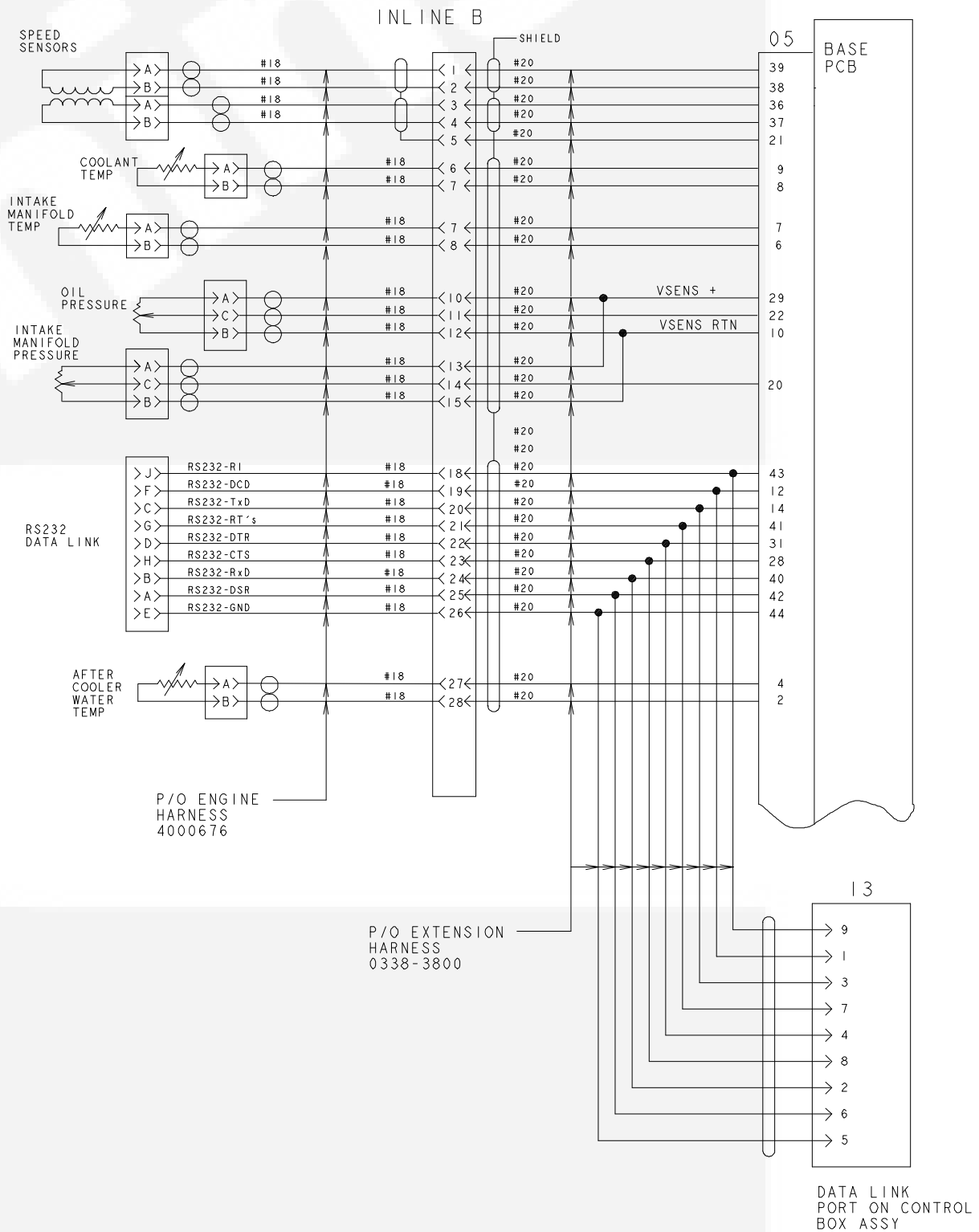
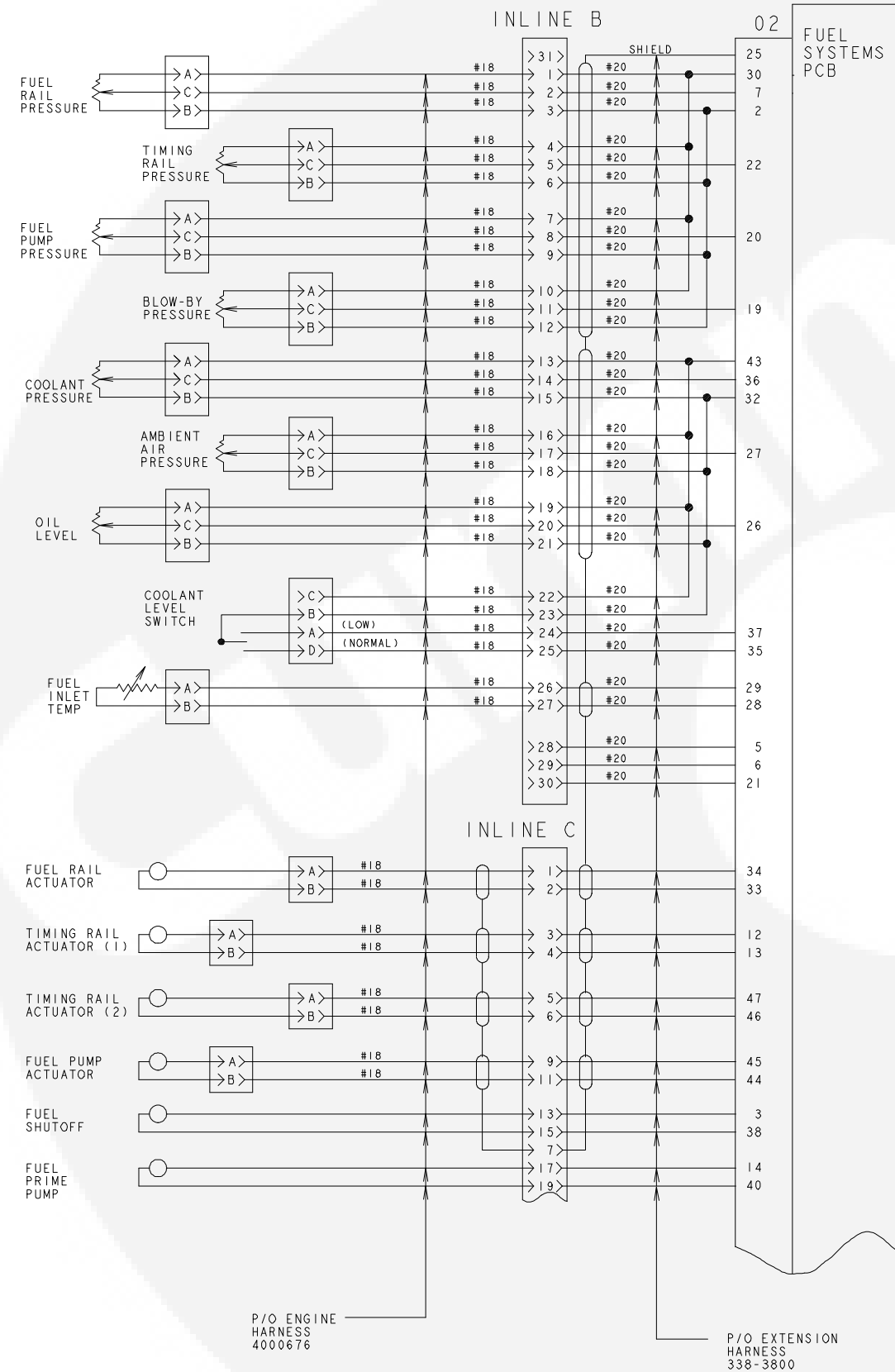
- ☐ Wire sizes, insulation, conduits and connection methods all meet applicable codes.
- ☐ AC and DC wires are separated in their own conduit to prevent electrical induction.
- ☐ All load, line and generator connections are proper and correct.
- ☐ Flexible conduit between generator set and building or surrounding structure.

## **GENERATOR SET PRESTART**

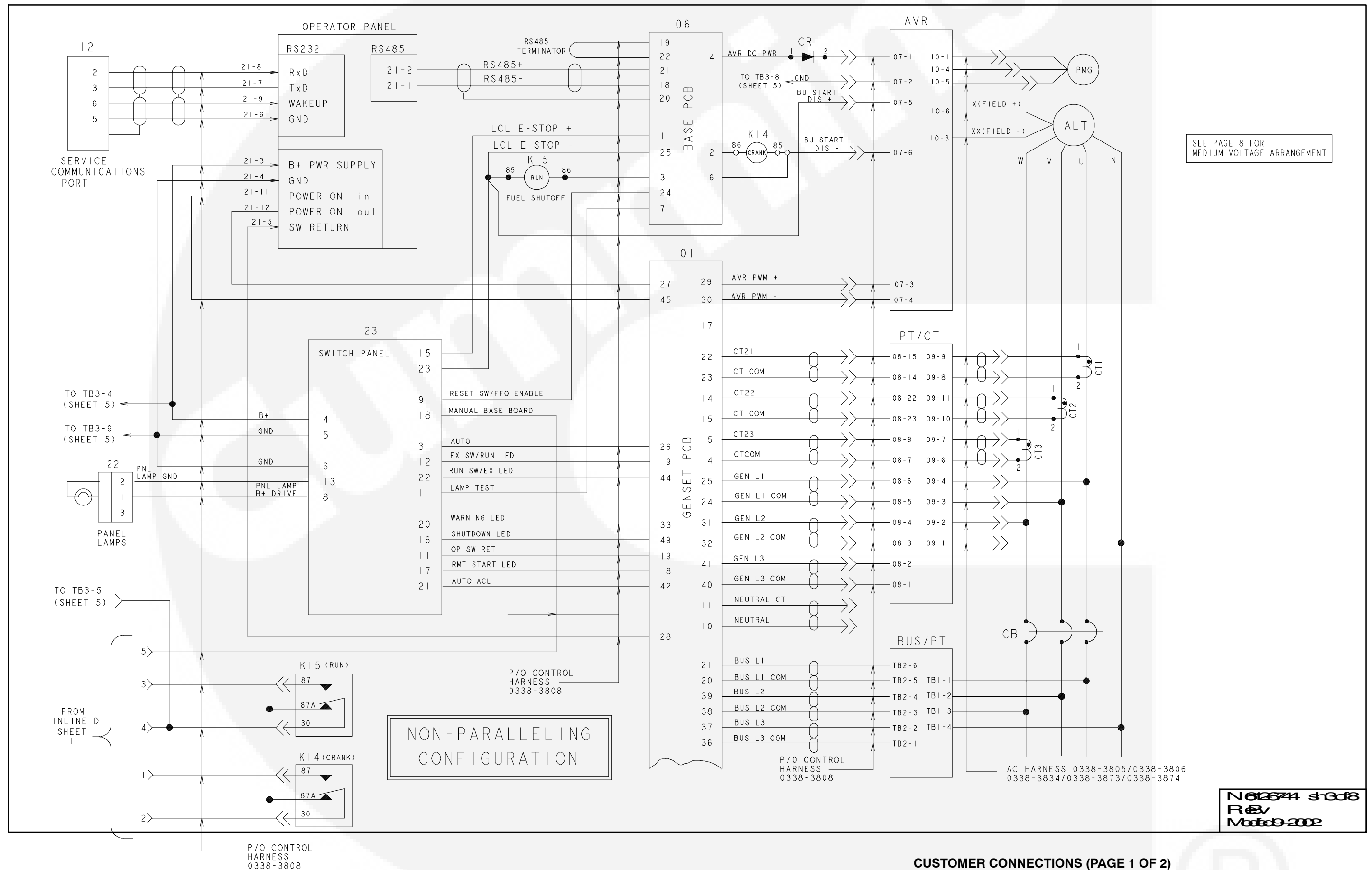
- ☐ Generator set engine is properly serviced with oil and coolant.
- ☐ Batteries are properly installed, serviced and charged.
- ☐ Battery charger and engine coolant heater are connected and operational.
- ☐ All generator set covers and safety shields are installed properly.
- ☐ All fuel and coolant shutoff valves are operational.

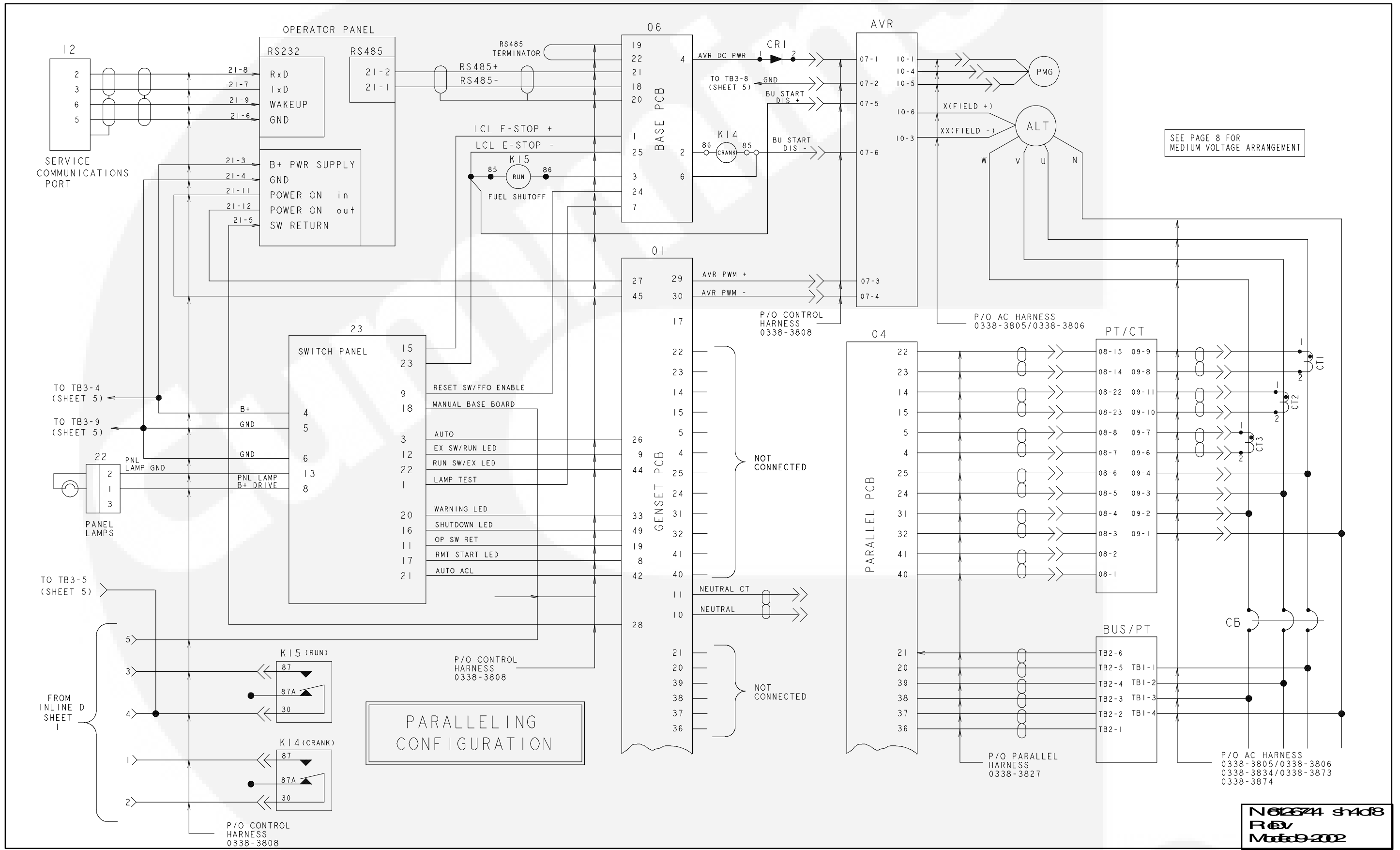


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Rev  
March 2002

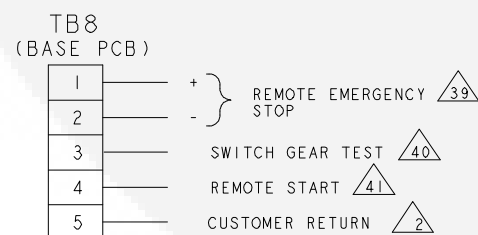
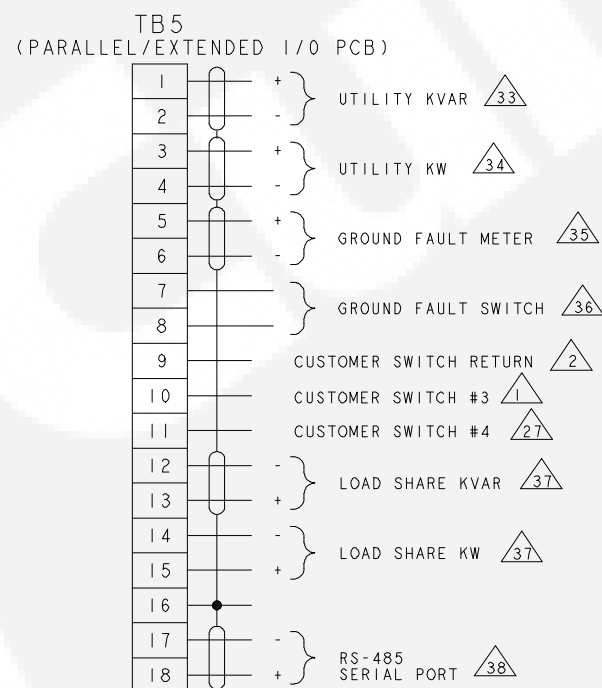
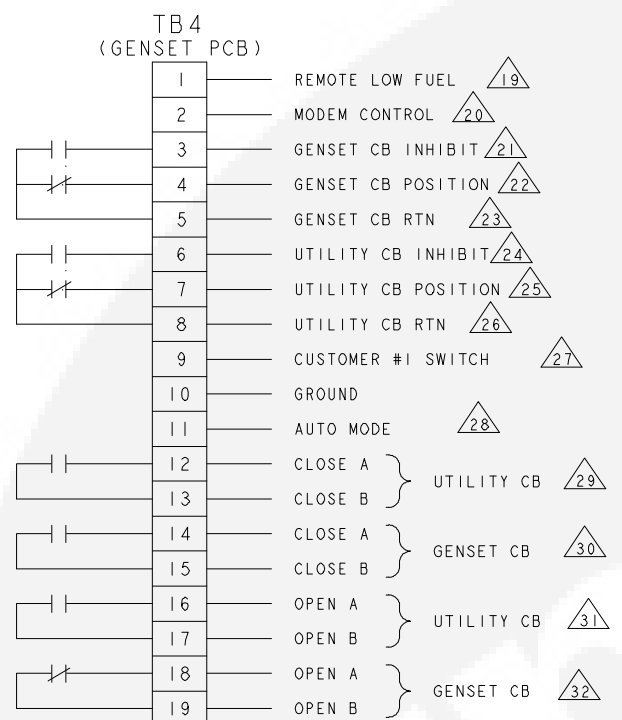




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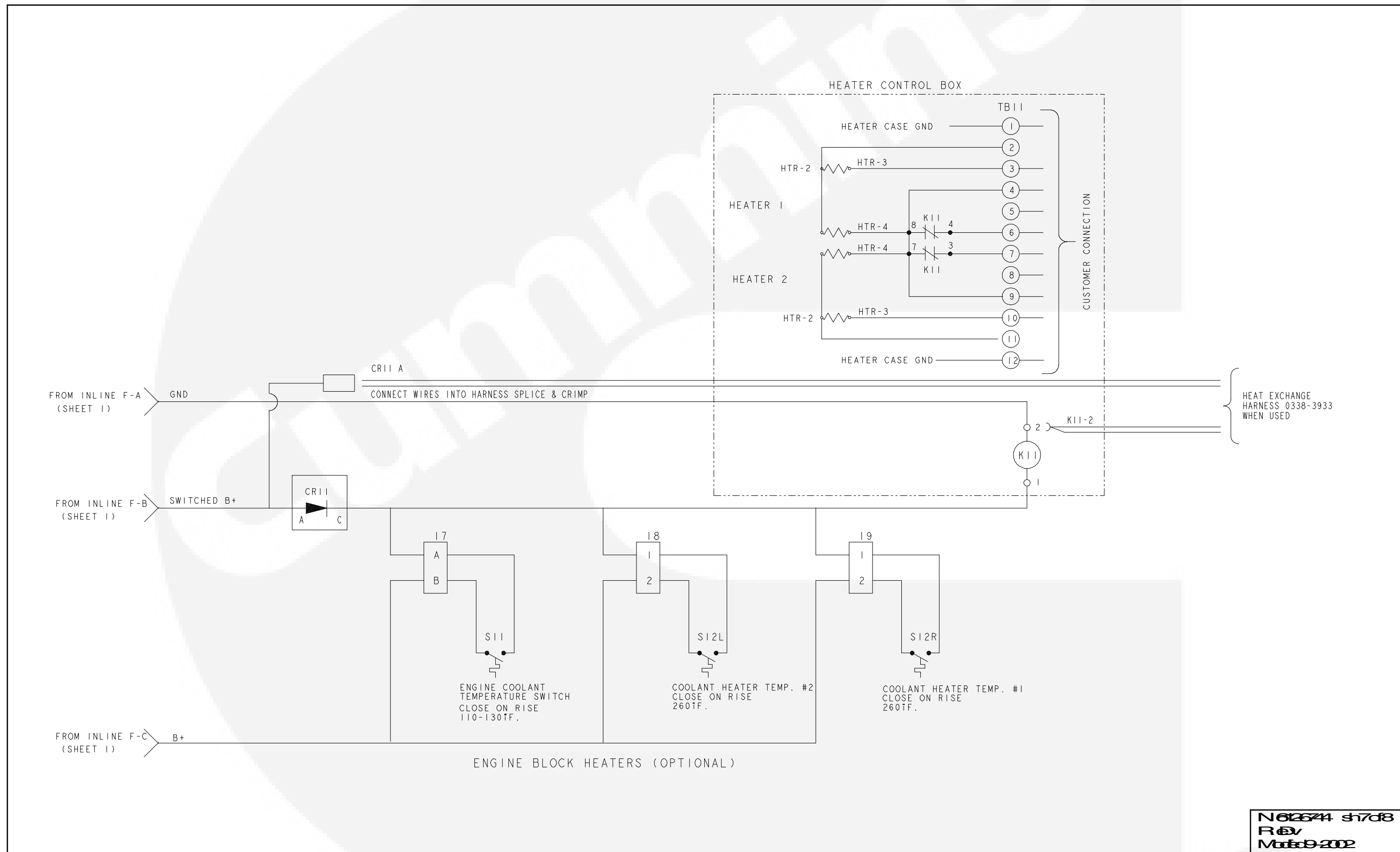


NOTES:

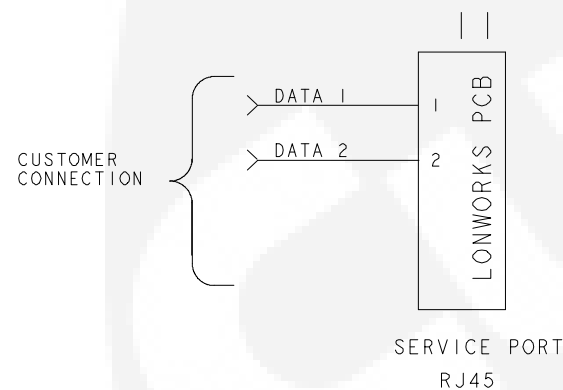
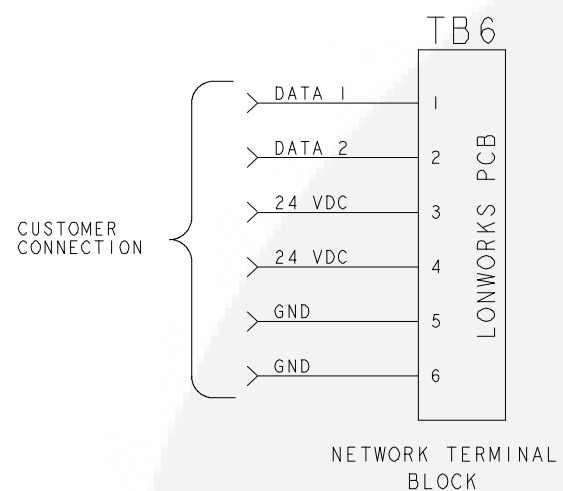
- 19 REMOTE LOW FUEL WARNING. APPLY TO GROUND OR LOW FUEL RTN TO ACTIVATE. ACTIVE LOW WITH LESS THAN 50mA CURRENT.
- 20 SELF PROTECTED RRELAY DRIVER (200mA @ 24VDC) FOR APPLYING POWER TO MODEM.
- 21 APPLY TO GENSET CB RETURN TO INHIBIT GENSET CB FROM CLOSING. ACTIVE LOW WITH LESS THAN 50mA CURRENT.
- 22 INPUT FROM GENSET CB "B" CONTACT TO INDICATE CB POSITION.
- 23 RETURN FOR GENSET CB INHIBIT AND POSITION.
- 24 APPLY TO UTILITY CB RETURN TO INHIBIT UTILITY CB FROM CLOSING. ACTIVE LOW WITH LESS THAN 50mA CURRENT.
- 25 INPUT FROM UTILITY CB "B" CONTACT TO INDICATE CB POSITION.
- 26 RETURN FOR UTILITY CB INHIBIT AND POSITION.
- 27 CUSTOMER WARNING OR SHUTDOWN SWITCH. CONFIGURABLE TO ACTIVE HIGH (B+) OR ACTIVE LOW (GND).
- 28 INDICATES GENSET IS IN AUTO MODE. ACTIVE HIGH (24VDC), FUSED AT 5A.
- 29 CLOSE RELAY CONTACT FOR UTILITY CB. FUSED AT 5A (N/O)
- 30 CLOSE RELAY CONTACT FOR GENSET CB. FUSED AT 5A (N/O)
- 31 OPEN RELAY CONTACT FOR UTILITY CB. FUSED AT 5A (N/O)
- 32 OPEN RELAY CONTACT FOR GENSET CB. FUSED AT 5A (N/C)
- 33 ANALOG MONITOR SIGNAL (0-5VDC) FOR UTILITY REACTIVE POWER.
- 34 ANALOG MONITOR SIGNAL (0-5VDC) FOR UTILITY REAL POWER.
- 35 ANALOG INPUT FOR GROUND FAULT CURRENT.
- 36 APPLY N/O RELAY CONTACT FROM GROUND FAULT RELAY.
- 37 PARALLEL LOAD SHARE LINES (0-1mA).
- 38 RS-485 SERIAL PORT CONNECTION.
- 39 OPEN CONNECTION TO INITIATE EMERGENCY STOP. THESE TERMINALS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP OPTION NOT USED.
- 40 DETERMINES START TYPE; APPLY TO CUSTOMER RTN FOR NORMAL START SEQUENCE WITH WARM-UP. OPEN=EMERGENCY START SEQUENCE.
- 41 APPLY TO CUSTOMER RETURN OR GROUND TO INITIATE A REMOTE START. ACTIVE LOW WITH LESS THAN 50mA CURRENT.

CUSTOMER CONNECTIONS

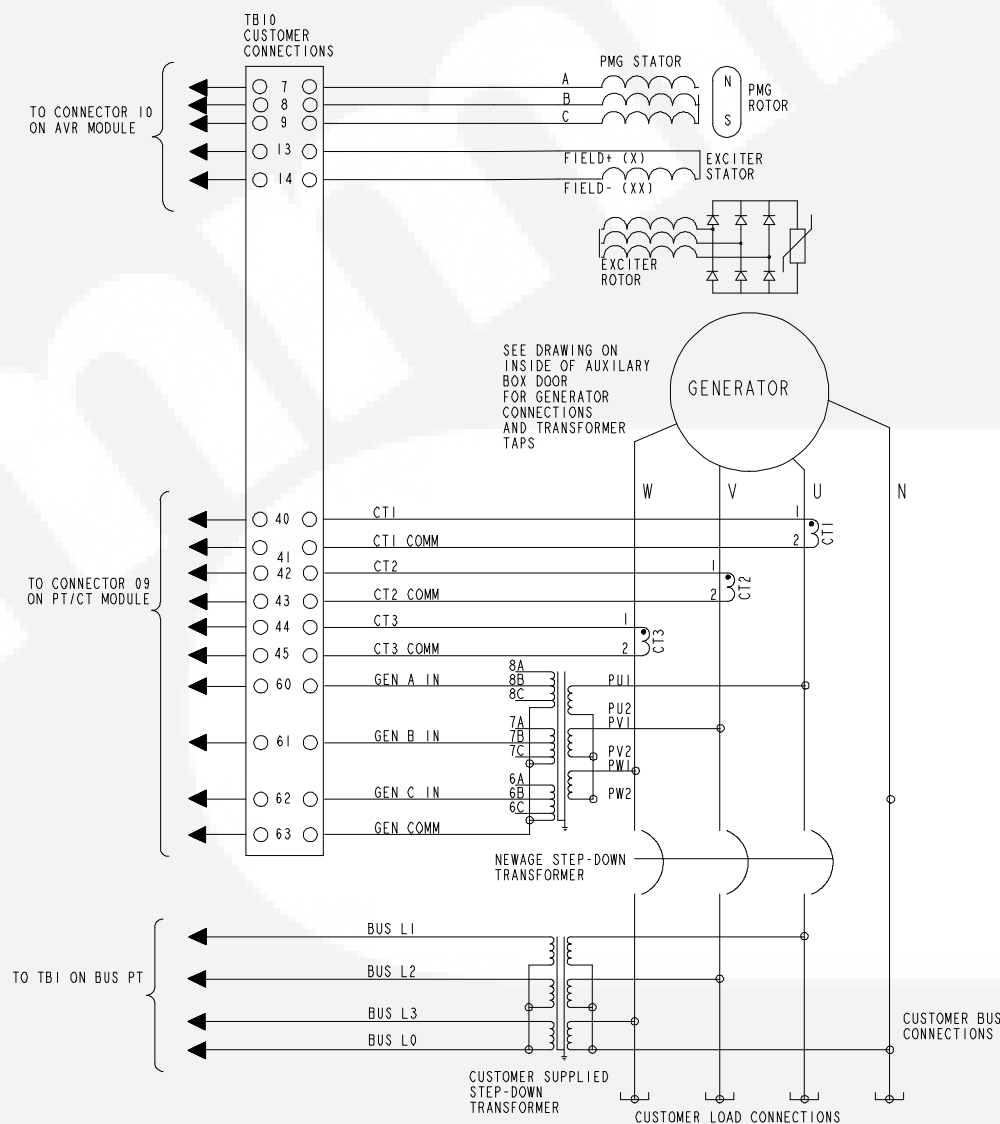
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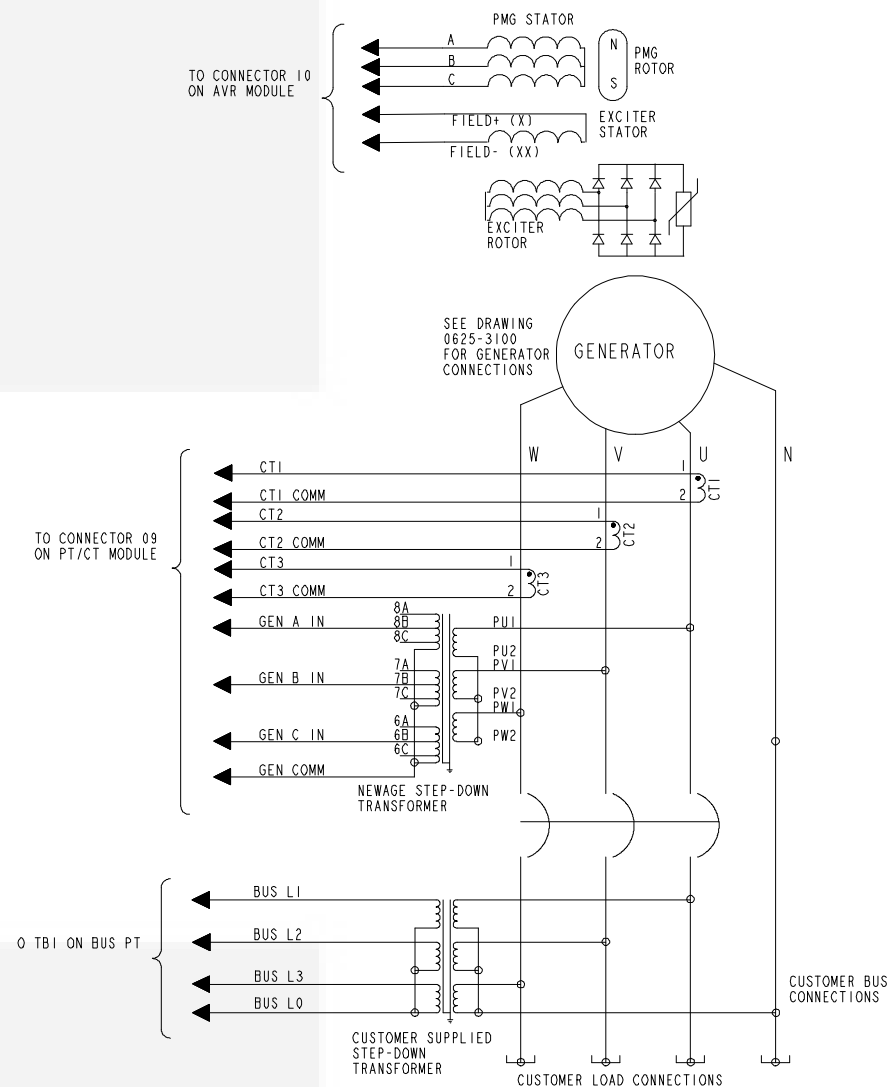
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LONWORKS OPTION



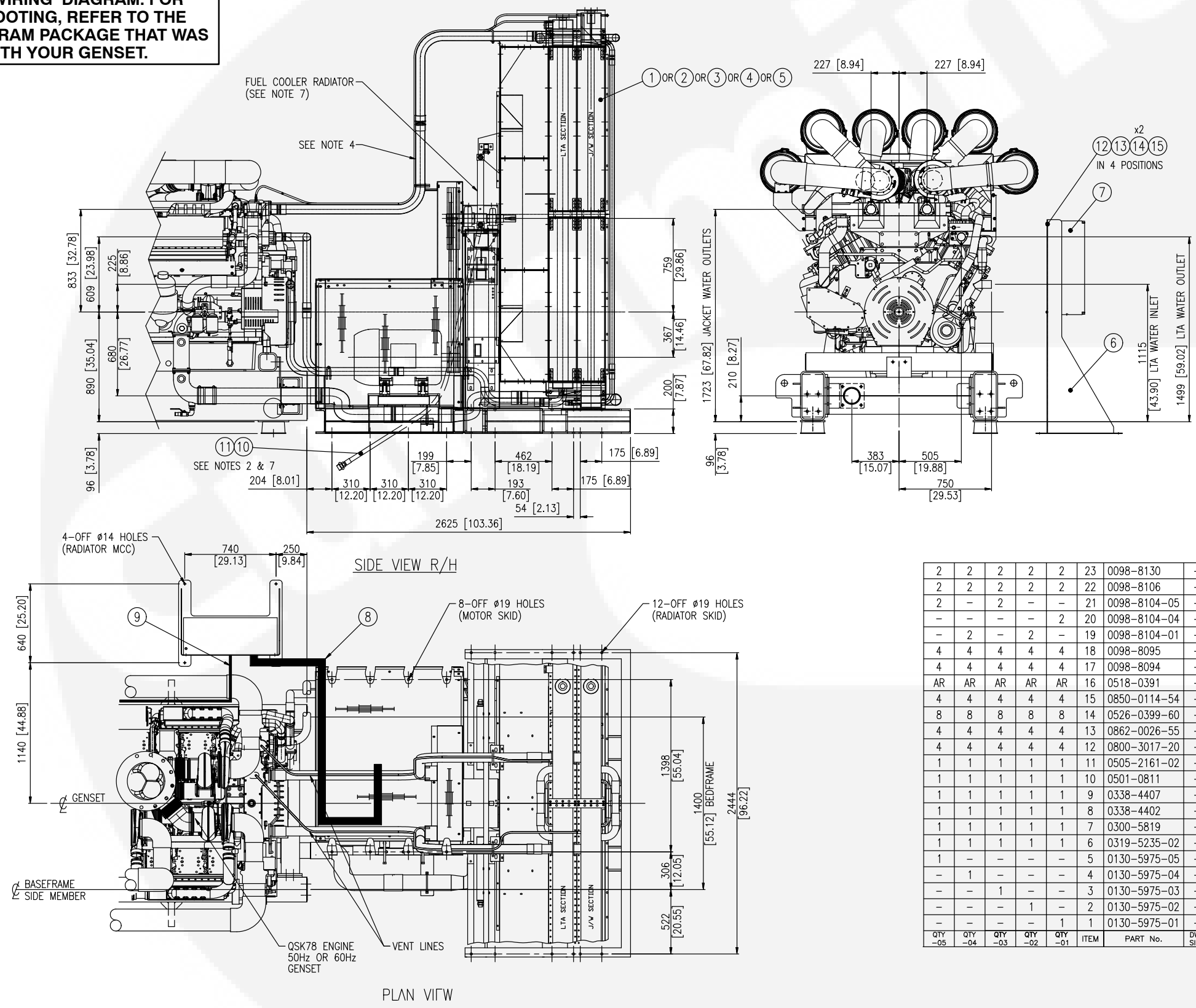
FRAME 8 MEDIUM VOLTAGE ARRANGEMENT



FRAME 7 MEDIUM VOLTAGE ARRANGEMENT

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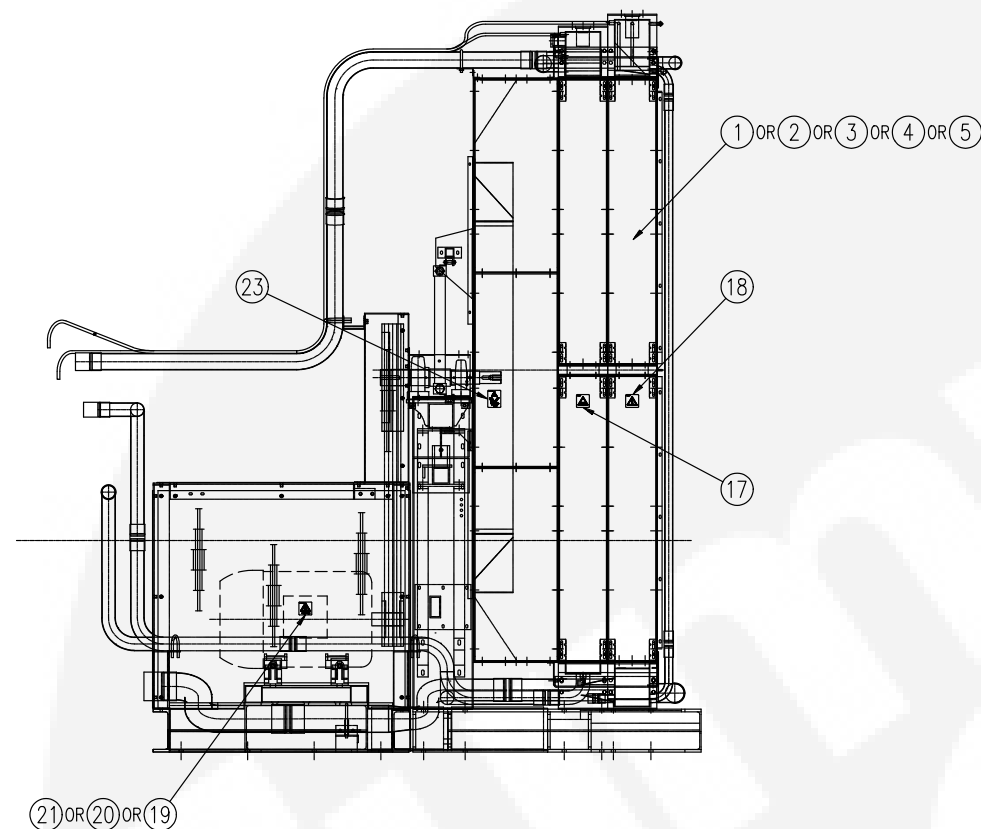


- NOTES:
- DIMENSIONS SHOWN IN ( ) BRACKETS ARE IN INCHES.
  - APPLY PIPE SEALANT (ITEM 16) TO ALL PIPE THREAD CONNECTIONS.
  - TORQUE HOSE CLAMPS TO 50 ±5 IN LBS
  - FOR RADIATOR PART DETAILS SEE DRAWING 0130-5975 SHT 2.
  - FOR LABEL POSITIONS SEE SHT 2 OF THIS DRAWING.
  - FOR WIRING DETAILS SEE SHT 3 OF THIS DRAWING.
  - FUEL HOSE ASSY & ADAPTER PIPE (ITEMS 10 & 11) TO BE REMOVED FROM ENGINE FUEL RETURN & FITTED TO RADIATOR FUEL COOLER, AS SHOWN.
  - BEARWARD SUPPLIED FUEL COOLER HOSES TO BE CONNECTED IN SERIES.
  - RADIATOR UNDERFRAME SPACER PLATES TO BE USED WHEN ALTERNATIVE HEIGHT ANTI-VIBRATION MOUNTS ARE EMPLOYED.
  - NOMINAL WEIGHT BASED ON SUPPLIER DATA: (DRY 2300KG WET 2705KG) NOT FOR INSPECTION.

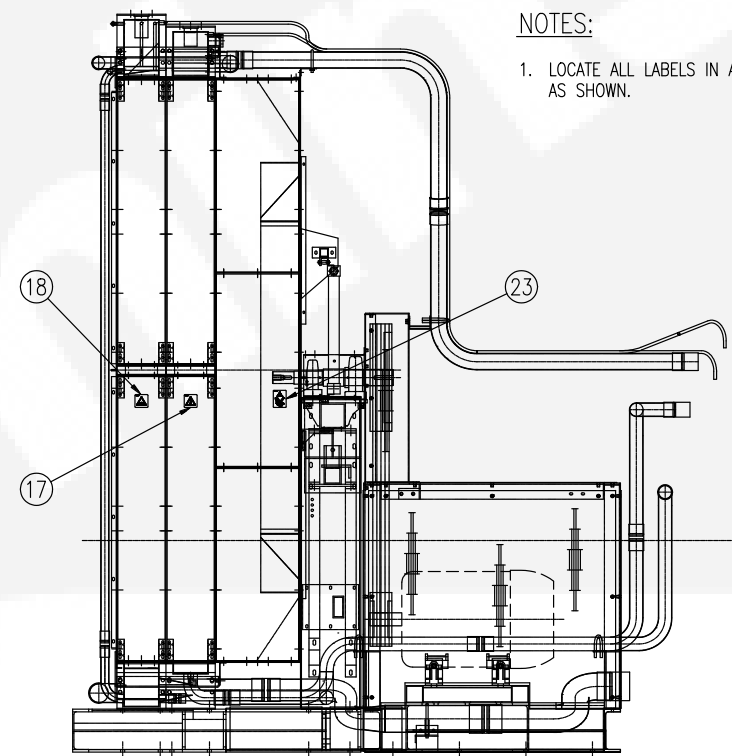
TABULATION			
PART NO.	VOLTAGES	Hz	CURRENT ER No.
0179-3301-01	380V-440V	50	ERK7475
0179-3301-02	380V	60	ERK7475
0179-3301-03	416V-480V	60	ERK7475
0179-3301-04	380V UL NEMA	60	ERK7475
0179-3301-05	416V-480V UL NEMA	60	ERK7475

2	2	2	2	2	23	0098-8130	-	LABEL-CAUTION (ROTATING PARTS)
2	2	2	2	2	22	0098-8106	-	LABEL-INFORMATION (TAG-WATER FILL)
2	-	2	-	-	21	0098-8104-05	-	LABEL-WARNING (480V AC)
-	-	-	-	2	20	0098-8104-04	-	LABEL-WARNING (440V AC)
-	2	-	2	-	19	0098-8104-01	-	LABEL-WARNING (380V AC)
4	4	4	4	4	18	0098-8095	-	LABEL-WARNING (HOT SURFACE)
4	4	4	4	4	17	0098-8094	-	LABEL-WARNING (PRESS LIQUID)
AR	AR	AR	AR	AR	16	0518-0391	-	SEALANT - THREAD
4	4	4	4	4	15	0850-0114-54	-	WASHER-LOCK (SPRING) M8
8	8	8	8	8	14	0526-0399-60	-	WASHER-FLAT STEEL M8
4	4	4	4	4	13	0862-0026-55	-	NUT-HEX M8x1.25
4	4	4	4	4	12	0800-3017-20	-	SCREW-HEX HD M8x1.25x25 LONG
1	1	1	1	1	11	0505-2161-02	-	ADAPTER-PIPE (1"BSP x 1-1/2" NPT M/M)
1	1	1	1	1	10	0501-0811	-	HOSE ASSY (1"BSP x 1"BSP 90° FM/FM)
1	1	1	1	1	9	0338-4407	-	HARNESS-CONTROL
1	1	1	1	1	8	0338-4402	-	HARNESS-POWER
1	1	1	1	1	7	0300-5819	-	CONTROL ASSY
1	1	1	1	1	6	0319-5235-02	-	FRAME-CABINET
1	-	-	-	-	5	0130-5975-05	-	RADIATOR (40°C ELECTRIC DRIVEN) 60Hz 416V-480V UL NEMA
-	1	-	-	-	4	0130-5975-04	-	RADIATOR (40°C ELECTRIC DRIVEN) 60Hz 380V UL NEMA
-	-	1	-	-	3	0130-5975-03	-	RADIATOR (40°C ELECTRIC DRIVEN) 60Hz 416V-480V
-	-	-	1	-	2	0130-5975-02	-	RADIATOR (40°C ELECTRIC DRIVEN) 60Hz 380V
-	-	-	-	1	1	0130-5975-01	-	RADIATOR (40°C ELECTRIC DRIVEN) 50Hz 380V-440V
QTY -05	QTY -04	QTY -03	QTY -02	QTY -01	ITEM	PART No.	DWG SIZE	DESCRIPTION OR MATERIAL

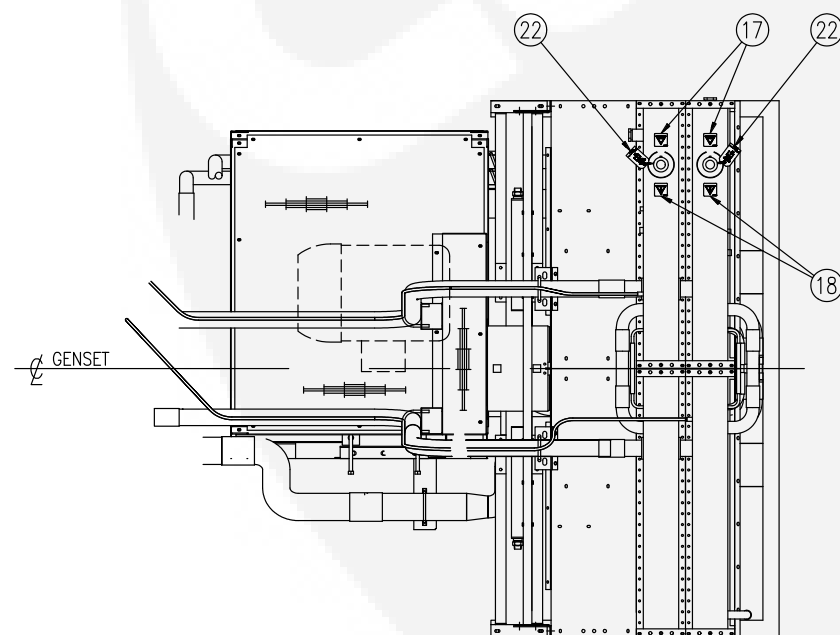
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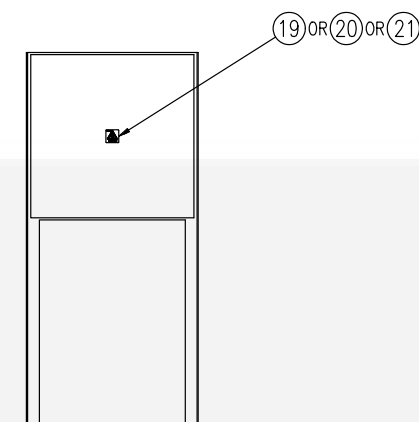
SIDE VIEW R/H



SIDE VIEW L/H



PLAN VIEW



CONTROL ASSY (ITEM 7)

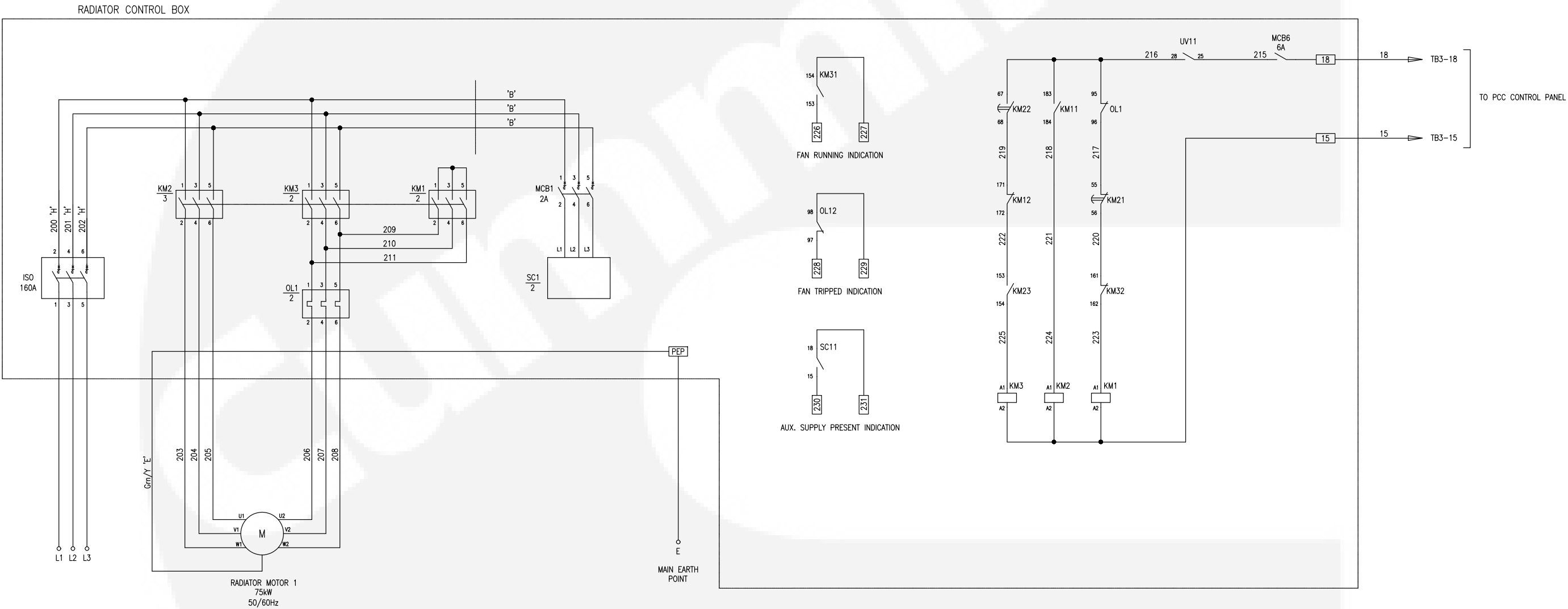
NOTES:

1. LOCATE ALL LABELS IN APPROXIMATE POSITIONS AS SHOWN.

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

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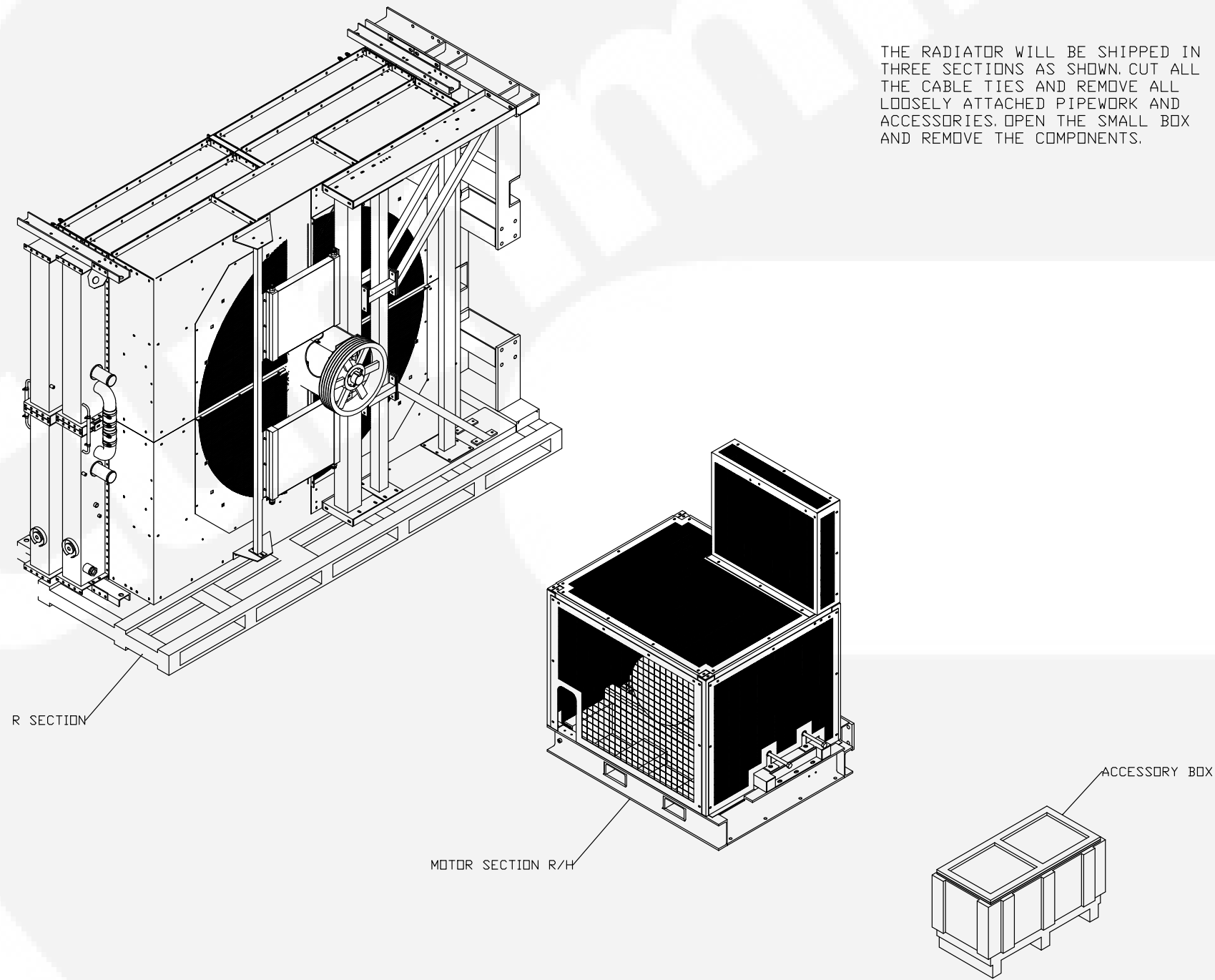


NOTES:-  
1. SPARE WIRES IN CONTROL HARNESS TO BE TIED BACK AND INSULATED

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THE RADIATOR WILL BE SHIPPED IN THREE SECTIONS AS SHOWN. CUT ALL THE CABLE TIES AND REMOVE ALL LOOSELY ATTACHED PIPEWORK AND ACCESSORIES. OPEN THE SMALL BOX AND REMOVE THE COMPONENTS.

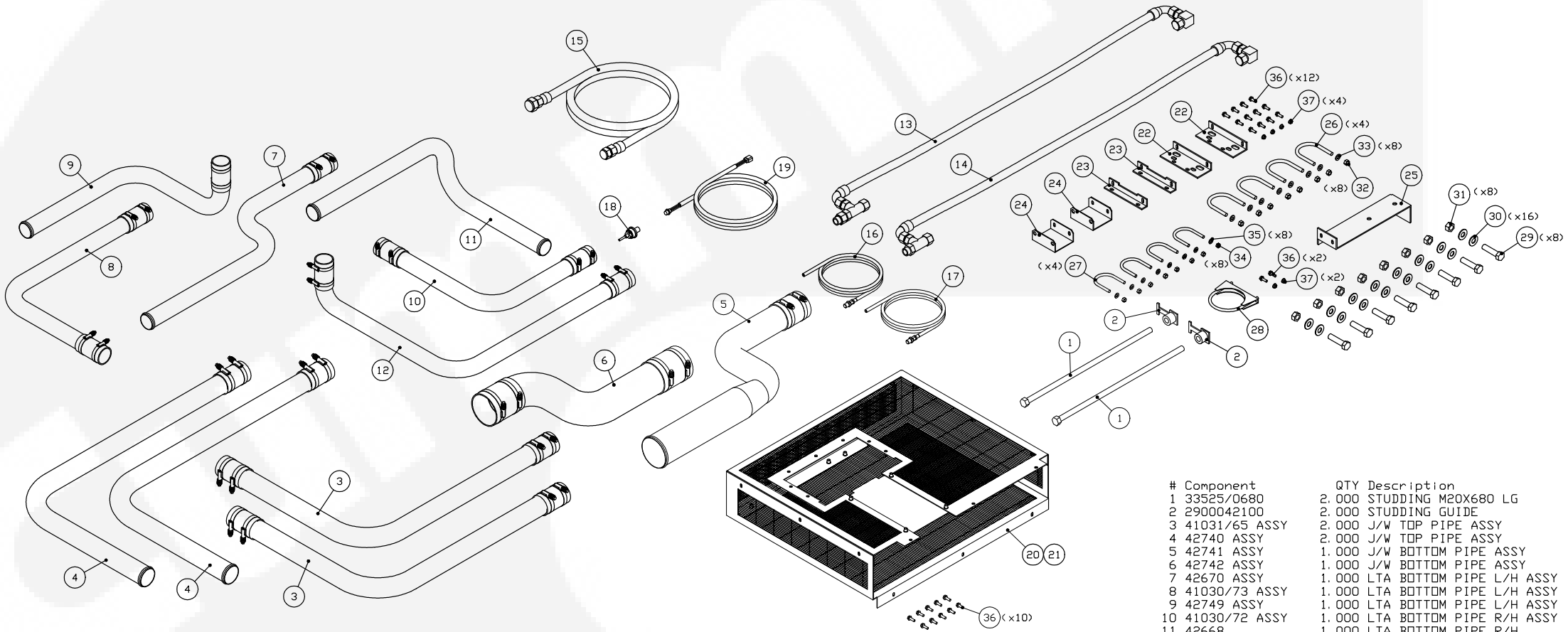


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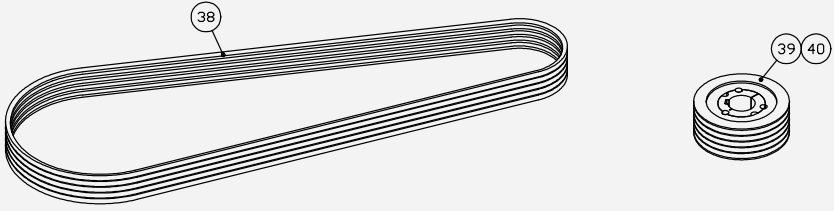


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LOOSE ACCESSORIES



THESE COMPONENTS WILL VARY DEPENDING ON RADIATOR VERSION  
(SEE SHEET 21 FOR DETAILS)



# Component	QTY Description
38 (see sht 21)	1.000 MATCHED BELT SET (5-OFF SPB)
39 (see sht 21)	1.000 PULLEY SPB 5G
40 (see sht 21)	1.000 TAPERLOCK BUSH

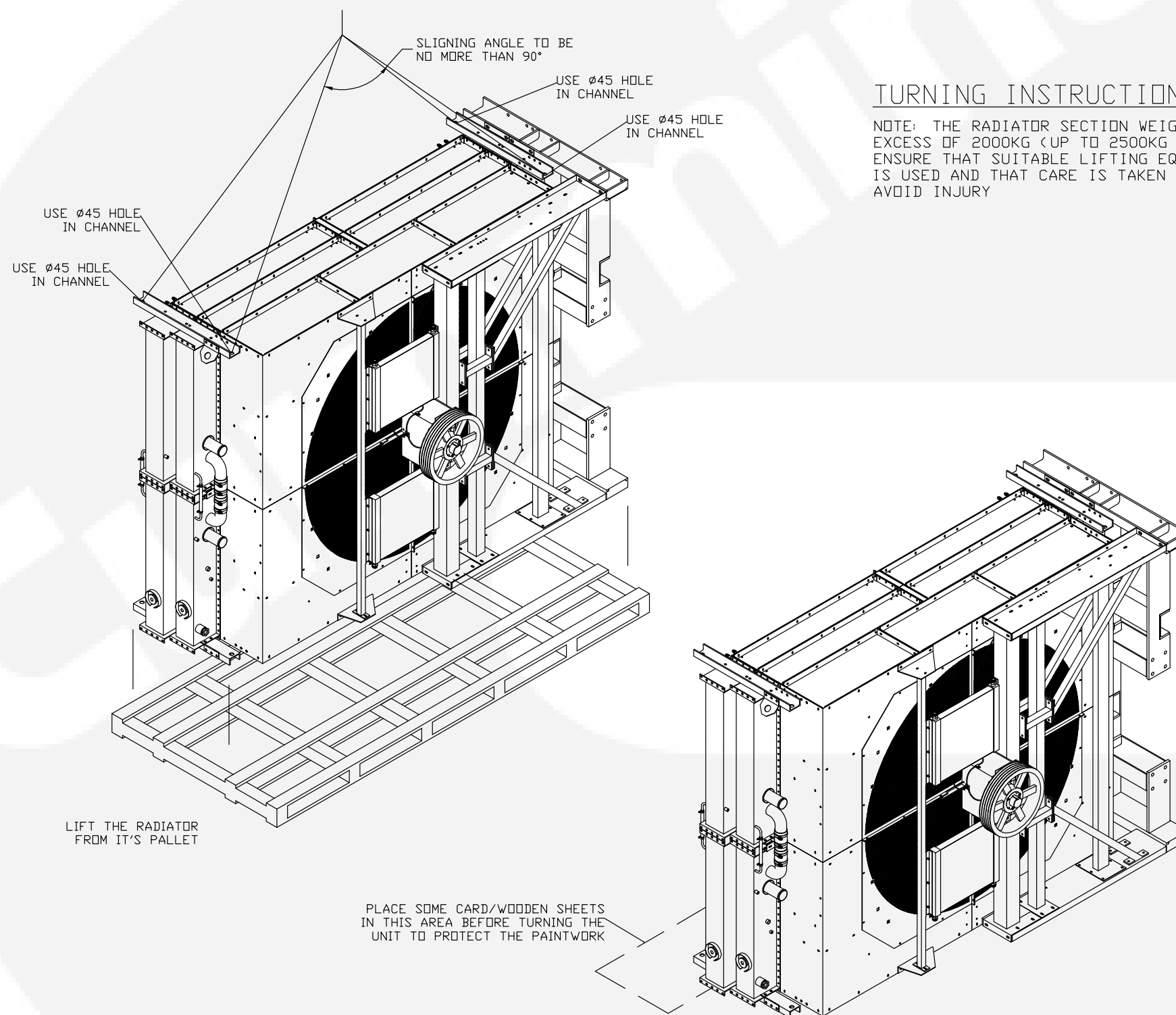
# Component	QTY Description
1 33525/0680	2.000 STUDDING M20X680 LG
2 2900042100	2.000 STUDDING GUIDE
3 41031/65 ASSY	2.000 J/W TOP PIPE ASSY
4 42740 ASSY	2.000 J/W TOP PIPE ASSY
5 42741 ASSY	1.000 J/W BOTTOM PIPE ASSY
6 42742 ASSY	1.000 J/W BOTTOM PIPE ASSY
7 42670 ASSY	1.000 LTA BOTTOM PIPE L/H ASSY
8 41030/73 ASSY	1.000 LTA BOTTOM PIPE L/H ASSY
9 42749 ASSY	1.000 LTA BOTTOM PIPE L/H ASSY
10 41030/72 ASSY	1.000 LTA BOTTOM PIPE R/H ASSY
11 42668	1.000 LTA BOTTOM PIPE R/H
12 42747 ASSY	1.000 LTA BOTTOM PIPE R/H ASSY
13 4000000900	1.000 FUEL LINE 1" DIA (INLET)
14 4000001000	1.000 FUEL LINE 1" DIA (OUTLET)
15 4000017000	1.000 FUEL LINE 1" DIA (TO ENGINE)
16 04955/203 ASSY	1.000 J/W VENT LINE 1/4"
17 04955/204 ASSY	1.000 LTA VENT LINE 1/4"
18 64337	1.000 SENDER-LOW COOLANT LEVEL
19 64338	1.000 HARNESS 0338-3832
20 17A113	1.000 PULLEY GUARD BACK PANEL
21 17A114	1.000 PULLEY GUARD FRONT PANEL
22 96468	2.000 PIPE SUPPORT BRACKET
23 96469	2.000 PIPE SUPPORT BRACKET
24 97706	2.000 PIPE SUPPORT BRACKET
25 97705	1.000 PIPE SUPPORT BRACKET
26 64102/65	4.000 U-BOLT (NOT TO GRIP)
27 64102/50	4.000 U-BOLT (NOT TO GRIP)
28 64348	1.000 U-BOLT CLAMP 5"
29 33575	8.000 M20X80 BOLT GRADE 10.9
30 33308025	16.000 M20 FLAT WASHER
31 33571	8.000 M20 NYLOC NUT GRADE 10
32 33037	8.000 M12 NYLOC NUT
33 33308012	8.000 M12 FLAT WASHER
34 33033	8.000 M10 NYLOC NUT
35 33308010	8.000 M10 FLAT WASHER
36 33610/8X25	24.000 M8X25-GR8.8-F/W17MM
37 33010	6.000 M8 COMBY NUT

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## TURNING INSTRUCTION 1

NOTE: THE RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UP TO 2500KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY

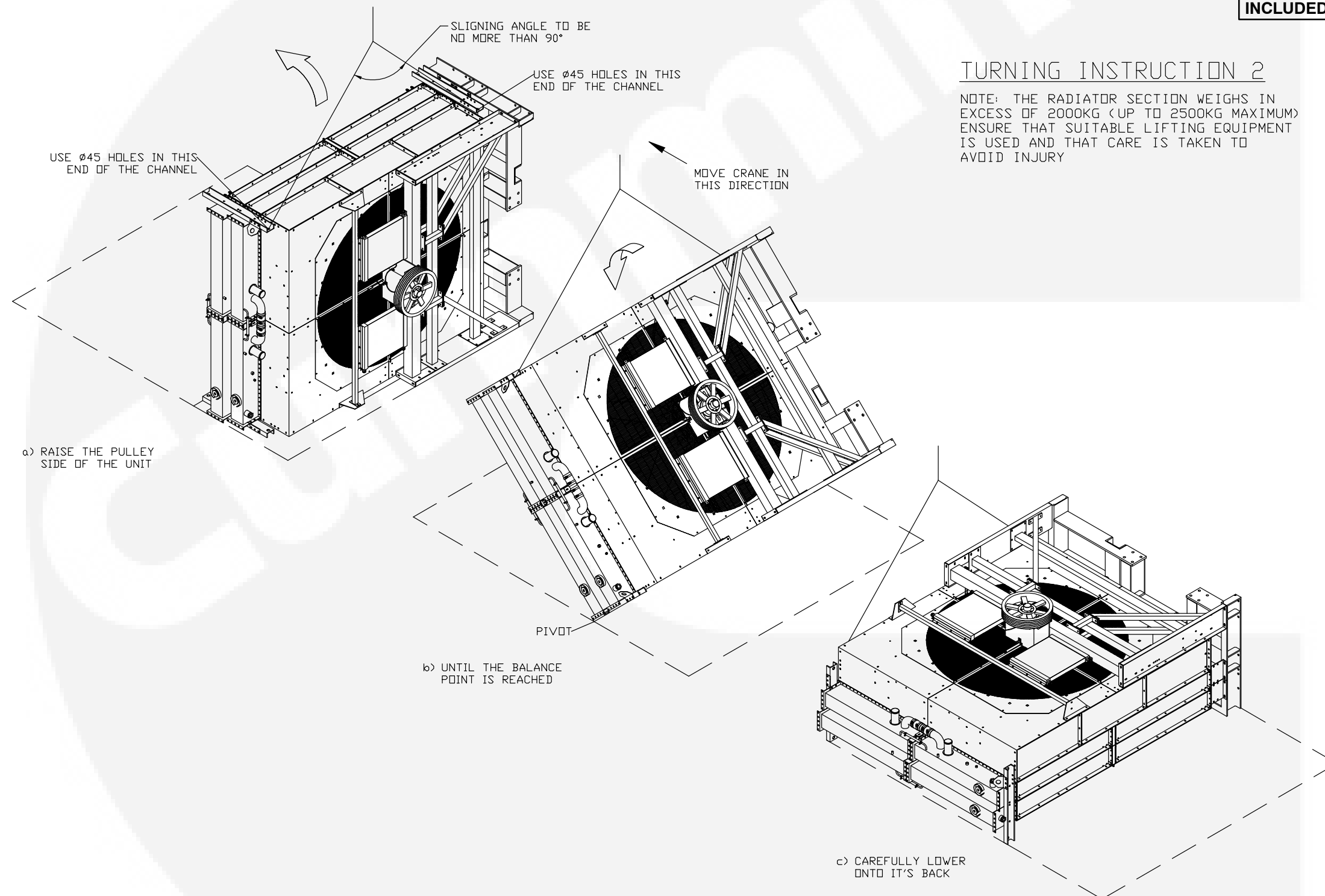


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## TURNING INSTRUCTION 2

NOTE: THE RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UP TO 2500KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY



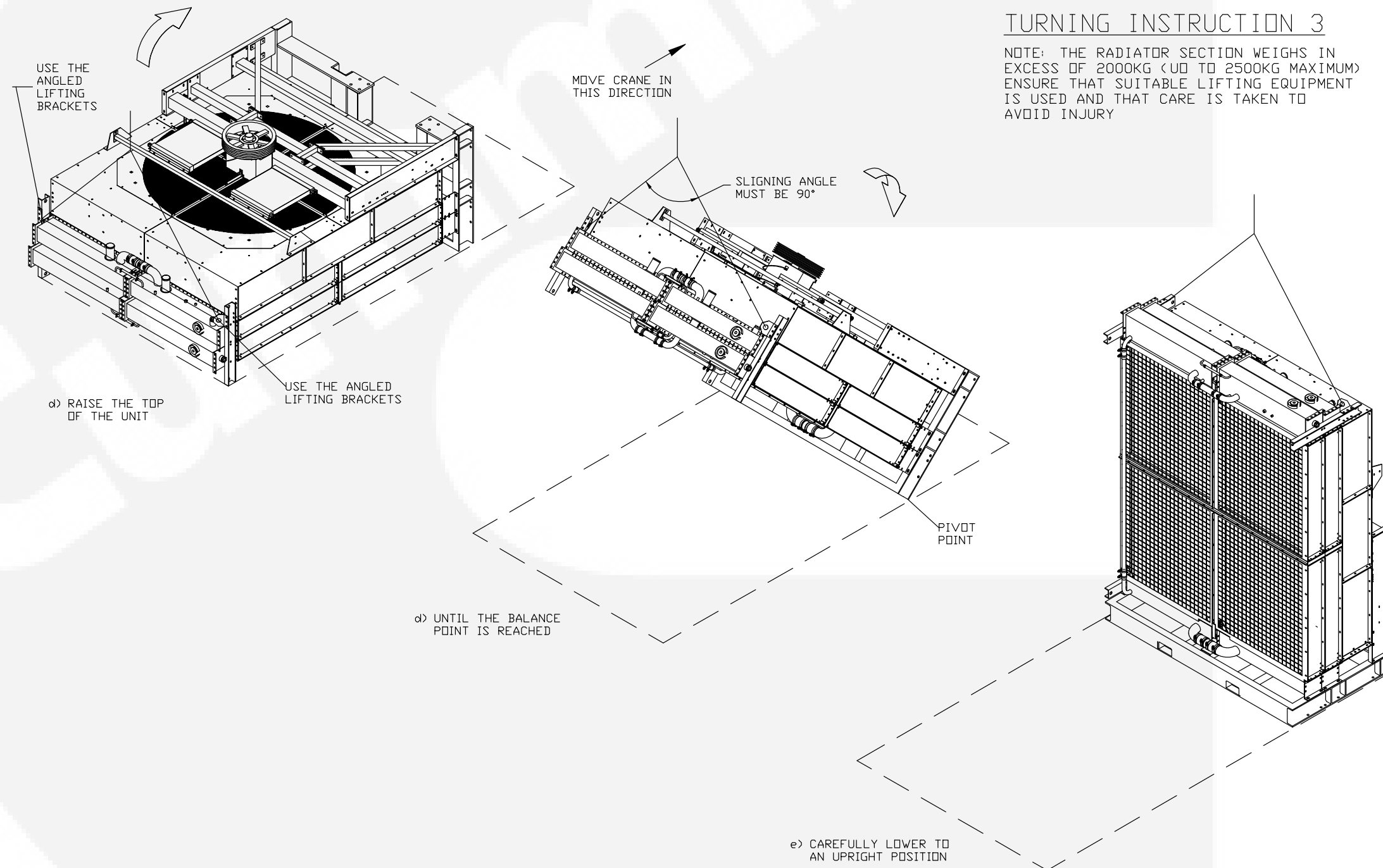
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COOLING SYSTEM INSTALLATION (40° C HIGH AMBIENT)

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### TURNING INSTRUCTION 3

NOTE: THE RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UP TO 2500KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY

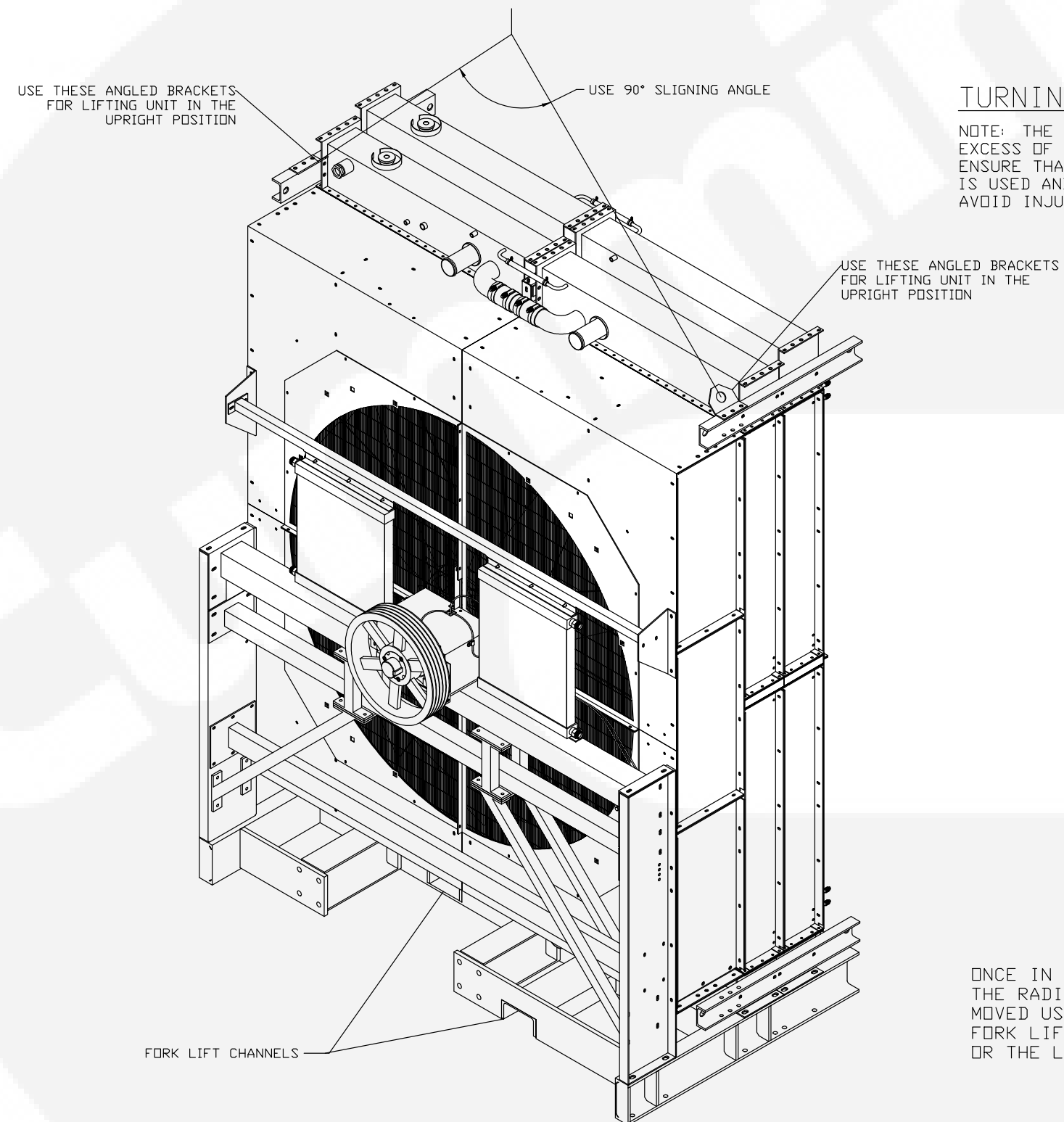


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Modified 4-2014

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#### TURNING INSTRUCTION 4

NOTE: THE RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UP TO 2500KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY



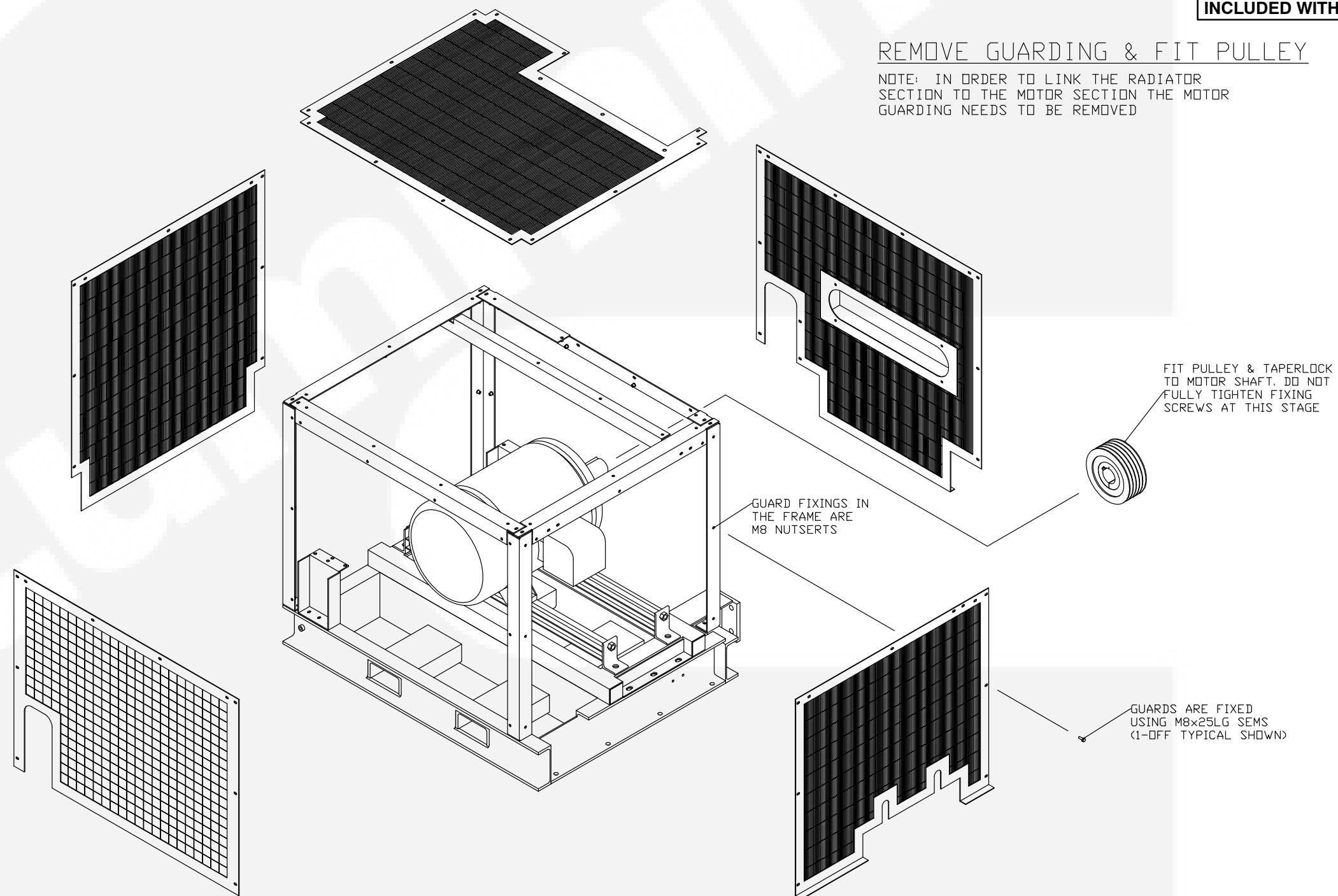
ONCE IN THE UPRIGHT POSITION THE RADIATOR SECTION CAN BE MOVED USING THE EITHER THE FORK LIFT CHANNELS IN THE BASE OR THE LIFTING BRACKETS SHOWN.

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## REMOVE GUARDING & FIT PULLEY

NOTE: IN ORDER TO LINK THE RADIATOR SECTION TO THE MOTOR SECTION THE MOTOR GUARDING NEEDS TO BE REMOVED



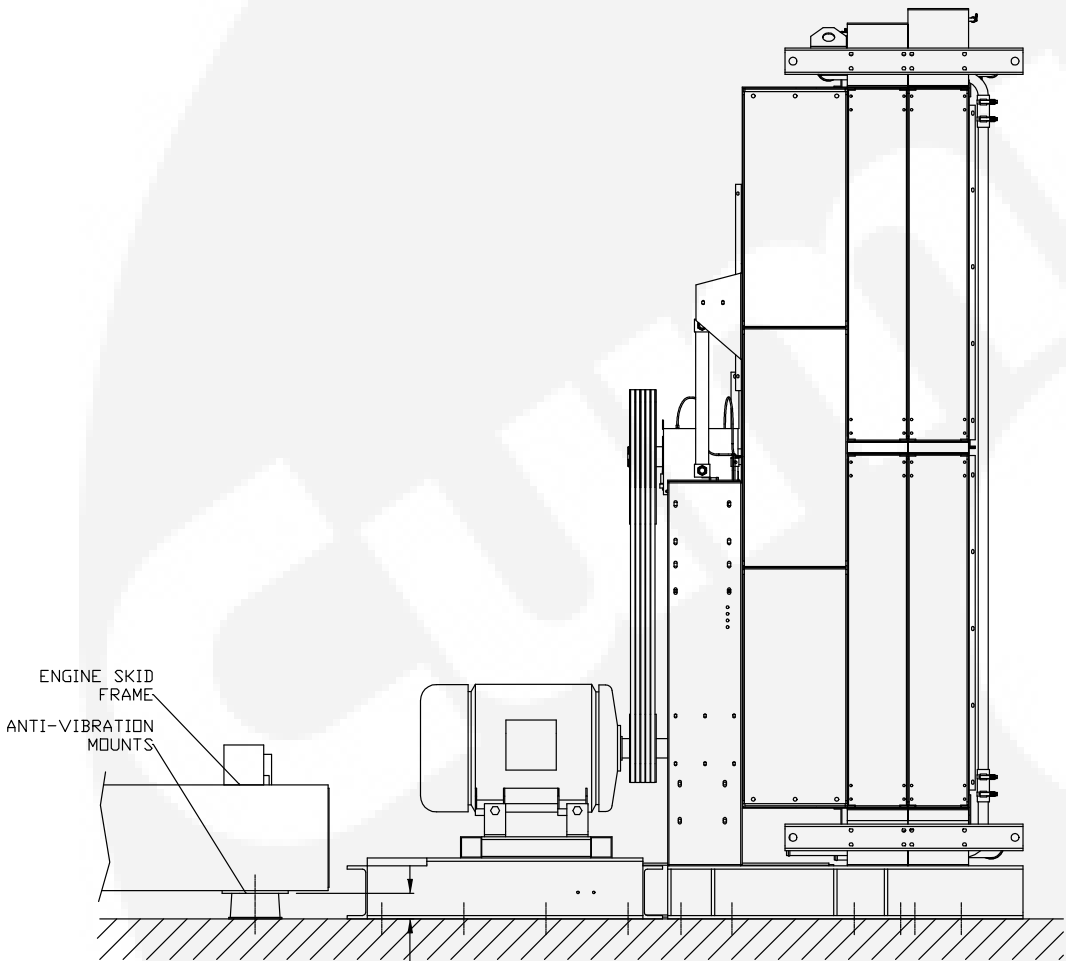
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COOLING SYSTEM INSTALLATION (40° C HIGH AMBIENT)

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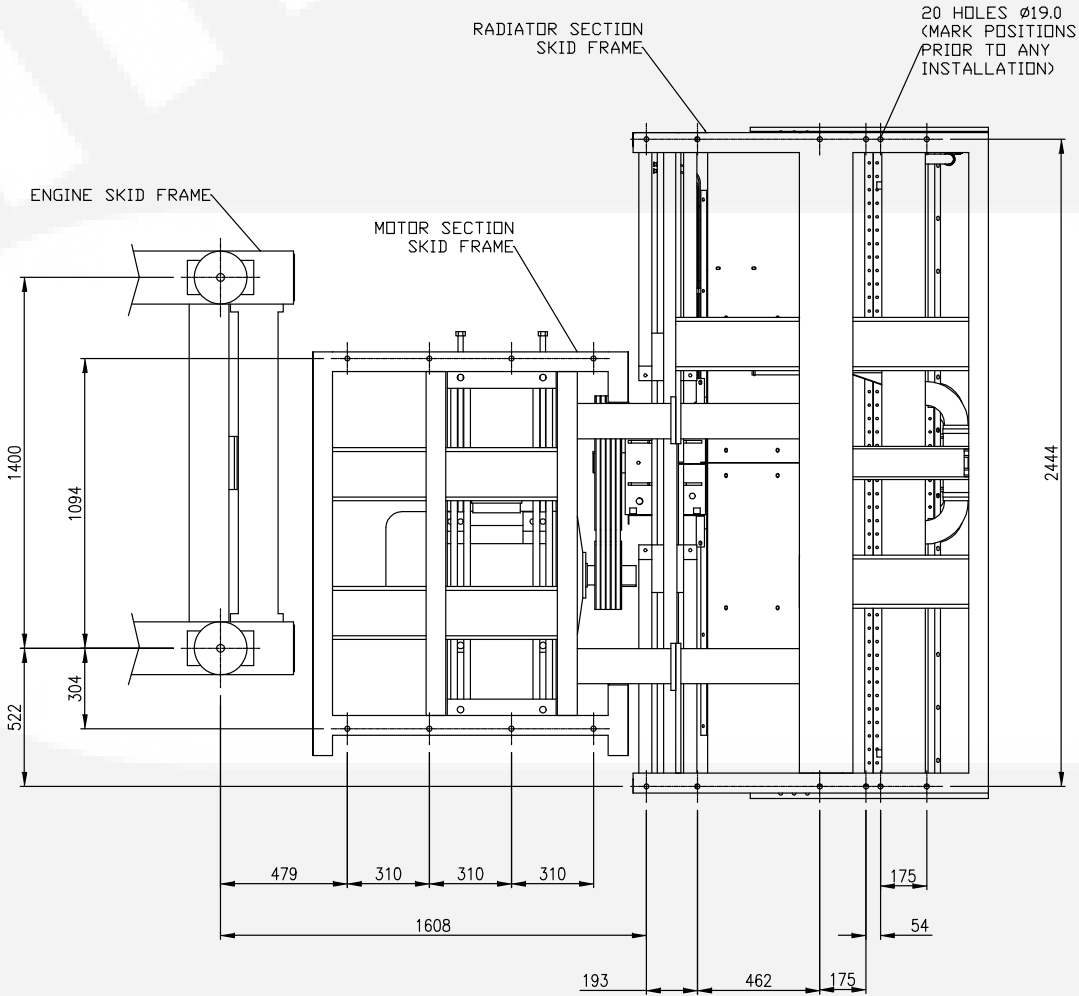
FIXING POSITIONS

NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATOR AND MOTOR SECTIONS MUST BE FIXED IN THE CORRECT POSITION, BOTH IN RELATION TO EACH OTHER AND THE ENGINE.



96  
\* THIS DIMENSION (FROM THE BOTTOM OF THE ENGINE SKID TO THE BOTTOM OF THE MOTOR & RADIATOR SKIDS) IS IMPORTANT. IF THE ANTI-VIBRATION MOUNTS USED ON THE GENSET CAUSE THIS DIMENSION TO BE GREATER THAN 96mm USE SHIMS TO RAISE THE RADIATOR SECTION AND THE MOTOR SECTION TO COMPENSATE.

R/H SIDE ELEVATION



UNDERSIDE ELEVATION

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COOLING SYSTEM INSTALLATION (40° C HIGH AMBIENT)

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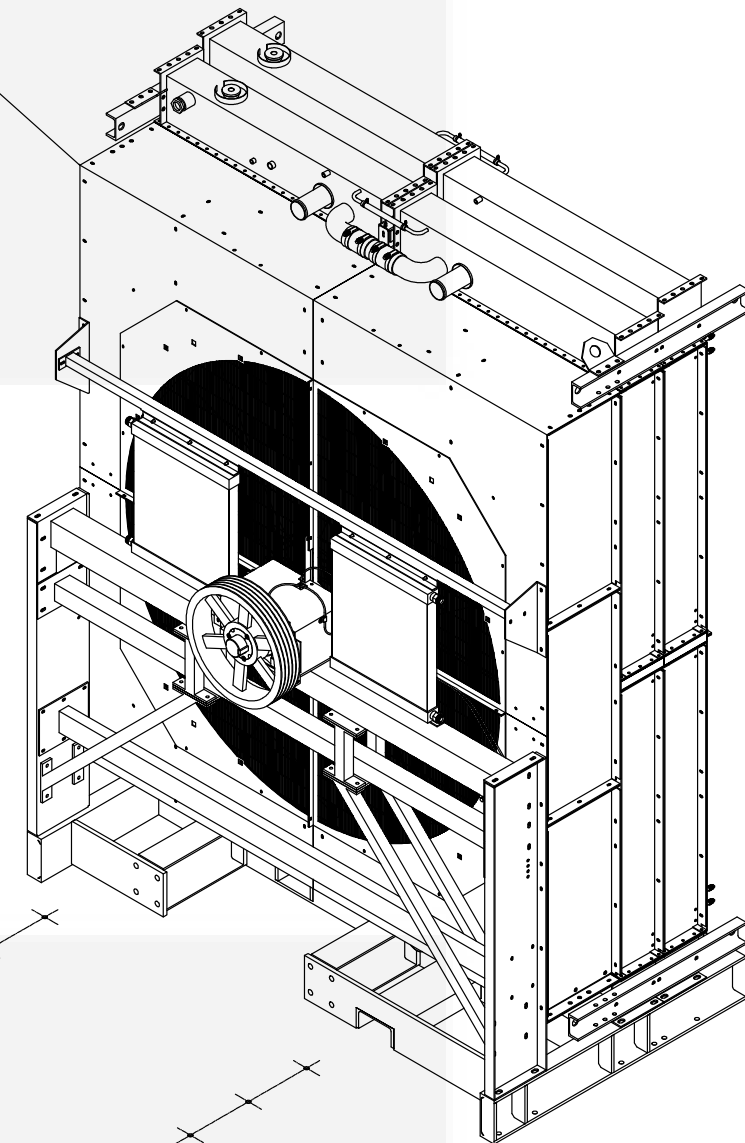
## INSTALL RADIATOR SECTION

NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATOR AND MOTOR SECTIONS MUST BE FIXED IN THE CORRECT POSITION. BOTH IN RELATION TO EACH OTHER AND THE ENGINE.

MOVE THE RADIATOR SECTION INTO POSITION - DO NOT FIX DOWN AT THIS STAGE

MARK OUT FIXING POSITIONS IN THE CONCRETE IN THE LOCATIONS SHOWN ON sht 8.

ENGINE SKID MOUNTING POSITIONS - FOR REF



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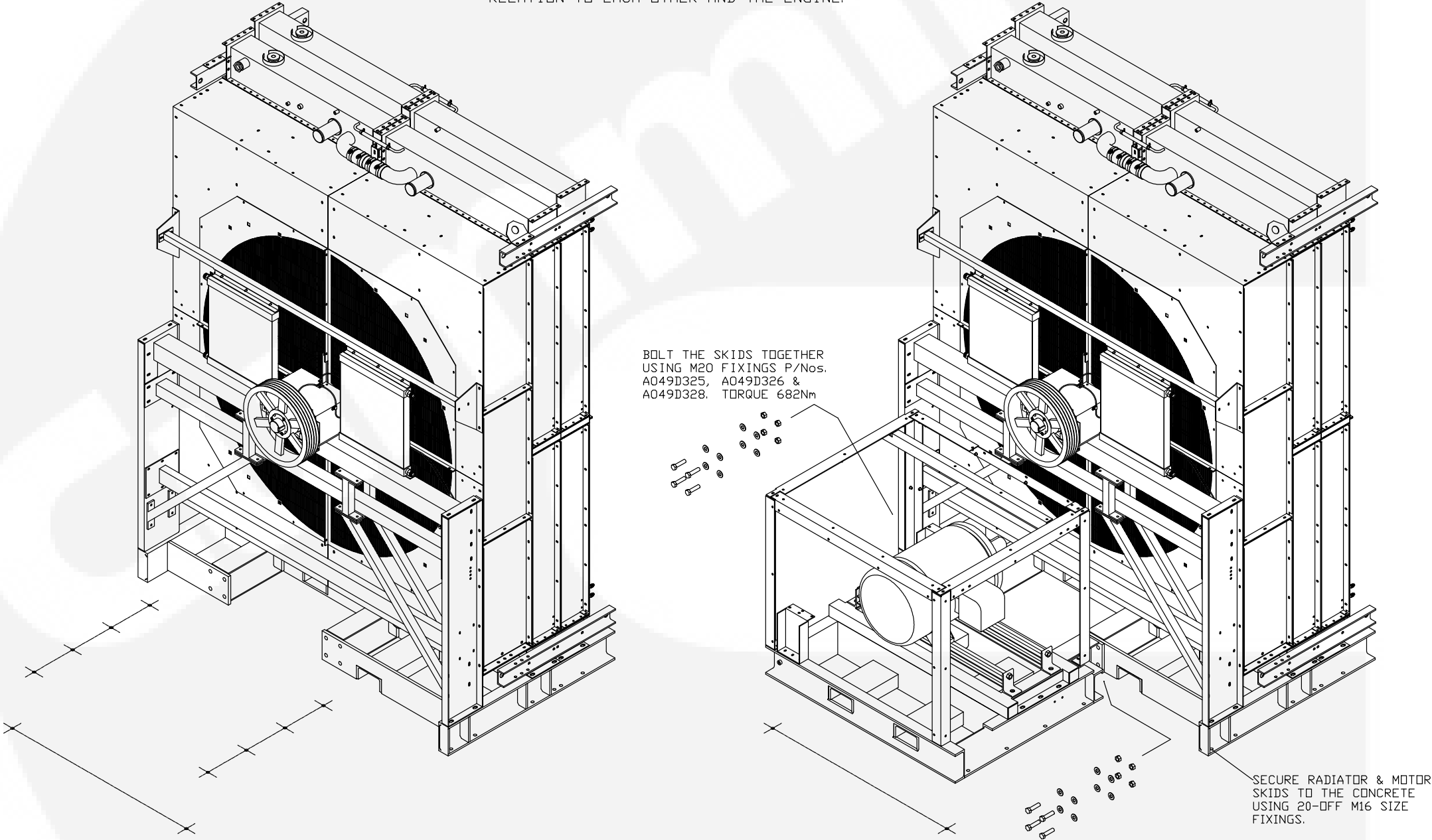
COOLING SYSTEM INSTALLATION (40° C HIGH AMBIENT)



INSTALL MOTOR SECTION

NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATOR AND MOTOR SECTIONS MUST BE FIXED IN THE CORRECT POSITION, BOTH IN RELATION TO EACH OTHER AND THE ENGINE.

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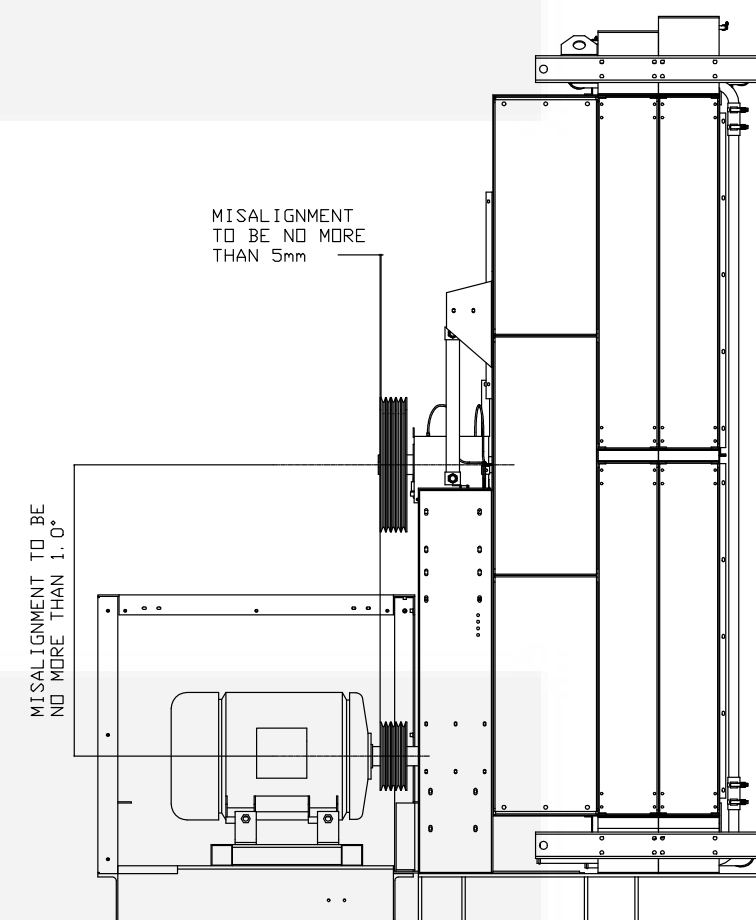
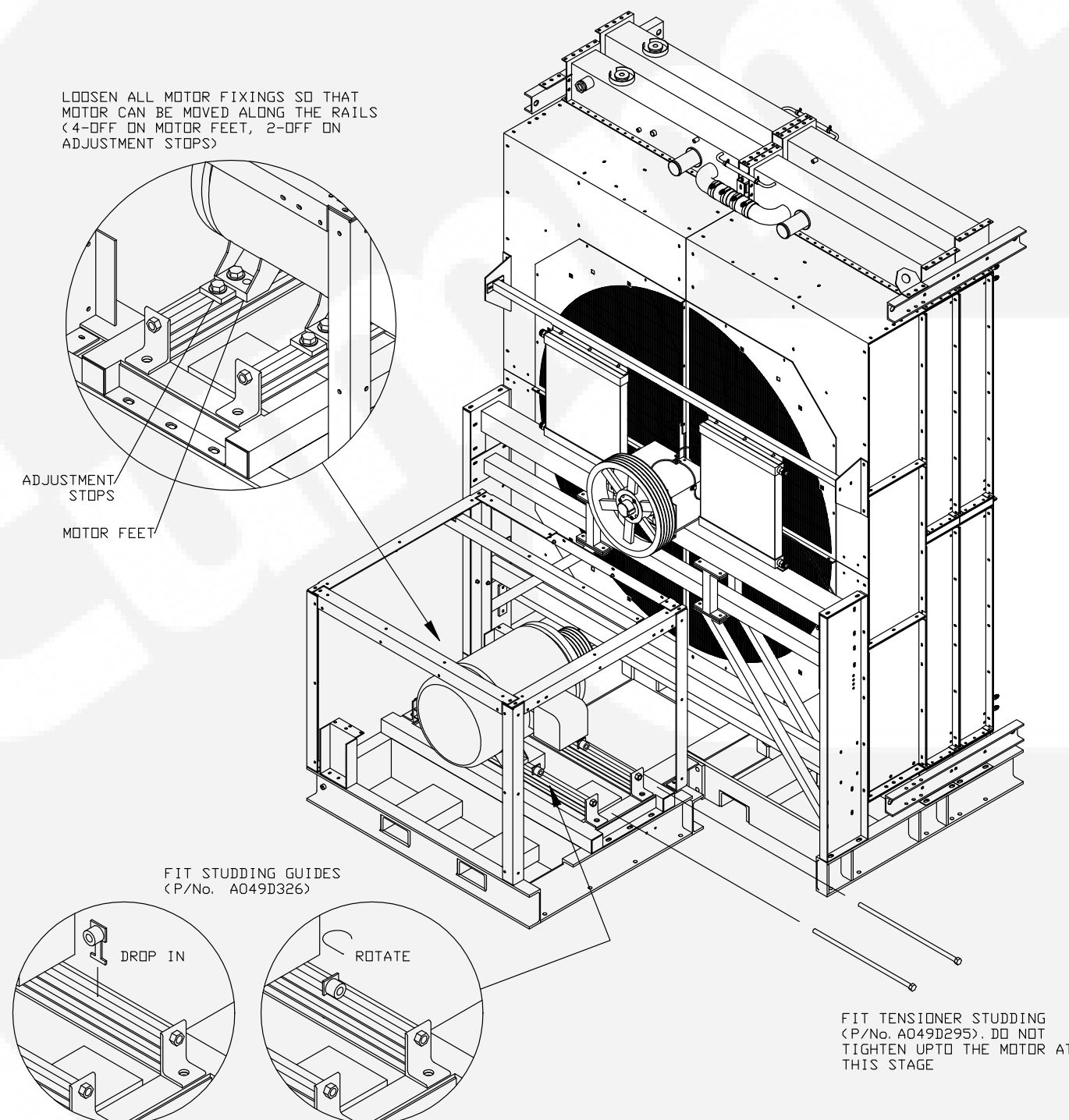


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## SET UP DRIVE 1

NOTE: THE DRIVE FROM THE MOTOR SECTION TO THE RADIATOR SECTION NEEDS TO BE SET UP CORRECTLY.

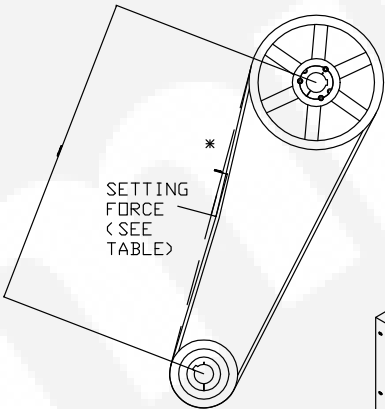


ALIGN MOTOR SHAFT PULLEY TO FAN SHAFT PULLEY. WHEN ALIGNED TIGHTEN SCREWS ON TAPERLOCK (GRADUALLY & ALTERNATELY) TORQUE: 110Nm

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BELT SECTION	SETTING FORCE TO DEFLECT BELT BY 16mm PER METRE SPAN	
	INITIAL INSTALL SETTING FORCE	RETENSIONING SETTING FORCE
SPB	77N (7.9 kgf)	62N (6.3 kgf)

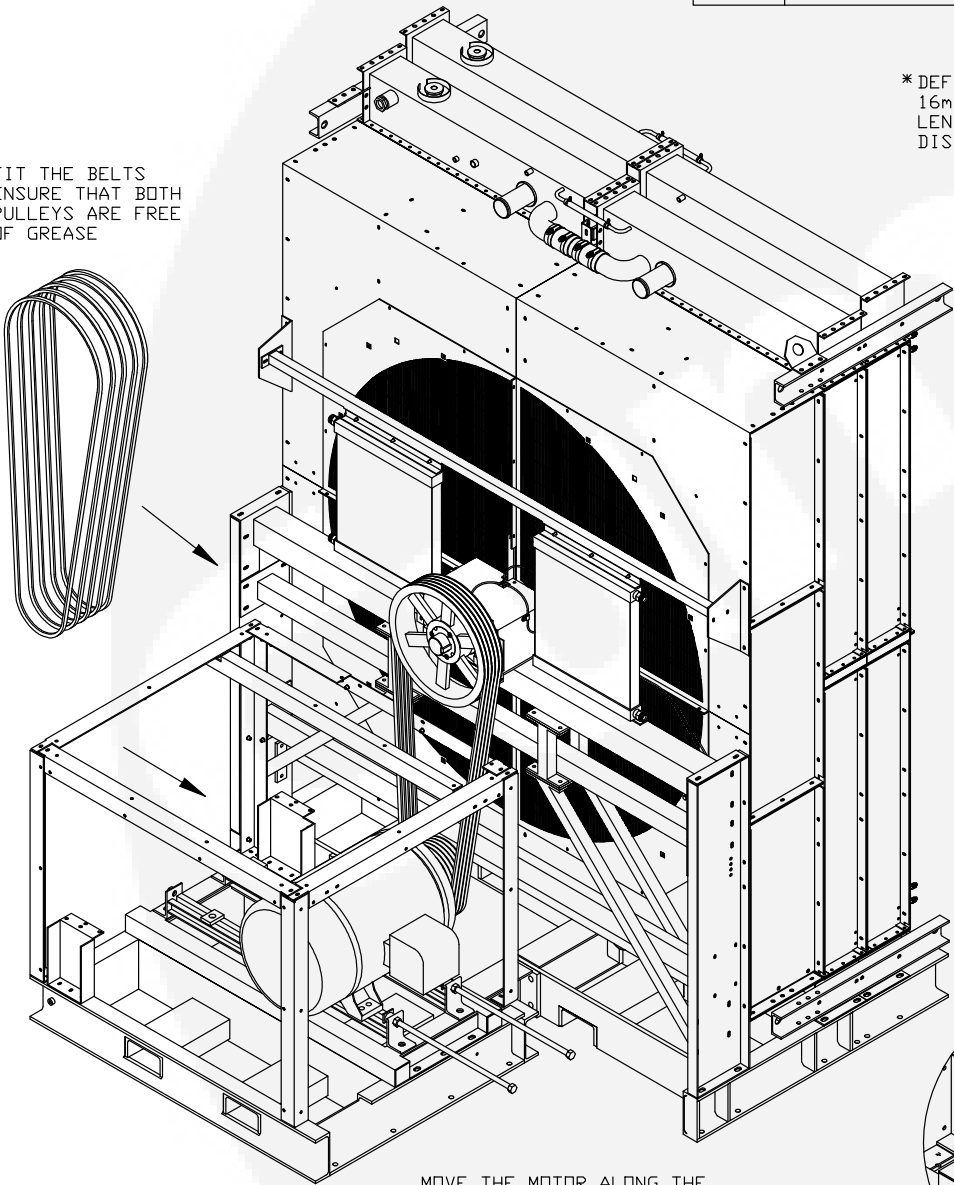


\* DEFLECTION TO BE 16mm PER 1 METRE LENGTH OF CENTRE DISTANCE.

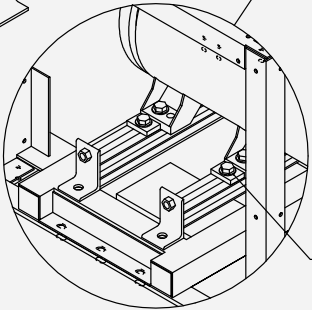
SET UP DRIVE 2

NOTE: THE DRIVE FROM THE MOTOR SECTION TO THE RADIATOR SECTION NEEDS TO BE SET UP CORRECTLY.

FIT THE BELTS ENSURE THAT BOTH PULLEYS ARE FREE OF GREASE

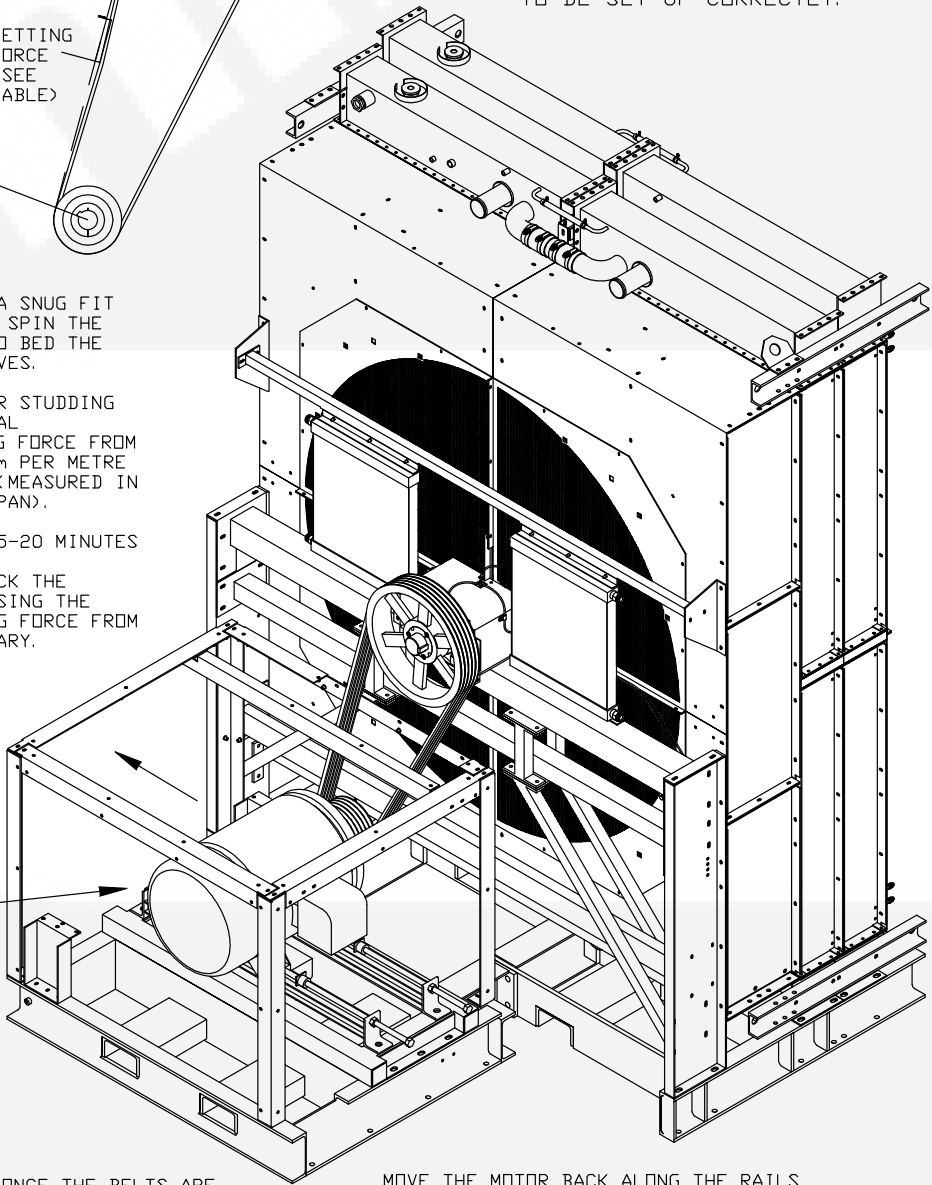


MOVE THE MOTOR ALONG THE RAILS FAR ENOUGH SO THAT THE BELTS CAN BE FITTED OVER BOTH PULLEYS WITHOUT NEEDING TO USE FORCE.



ONCE THE BELTS ARE CORRECTLY TENSIONED MOVE THE ADJUSTMENT STOPS UP TO THE MOTOR FEET AND TIGHTEN ALL 6-OFF BOLTS. TORQUE 350Nm

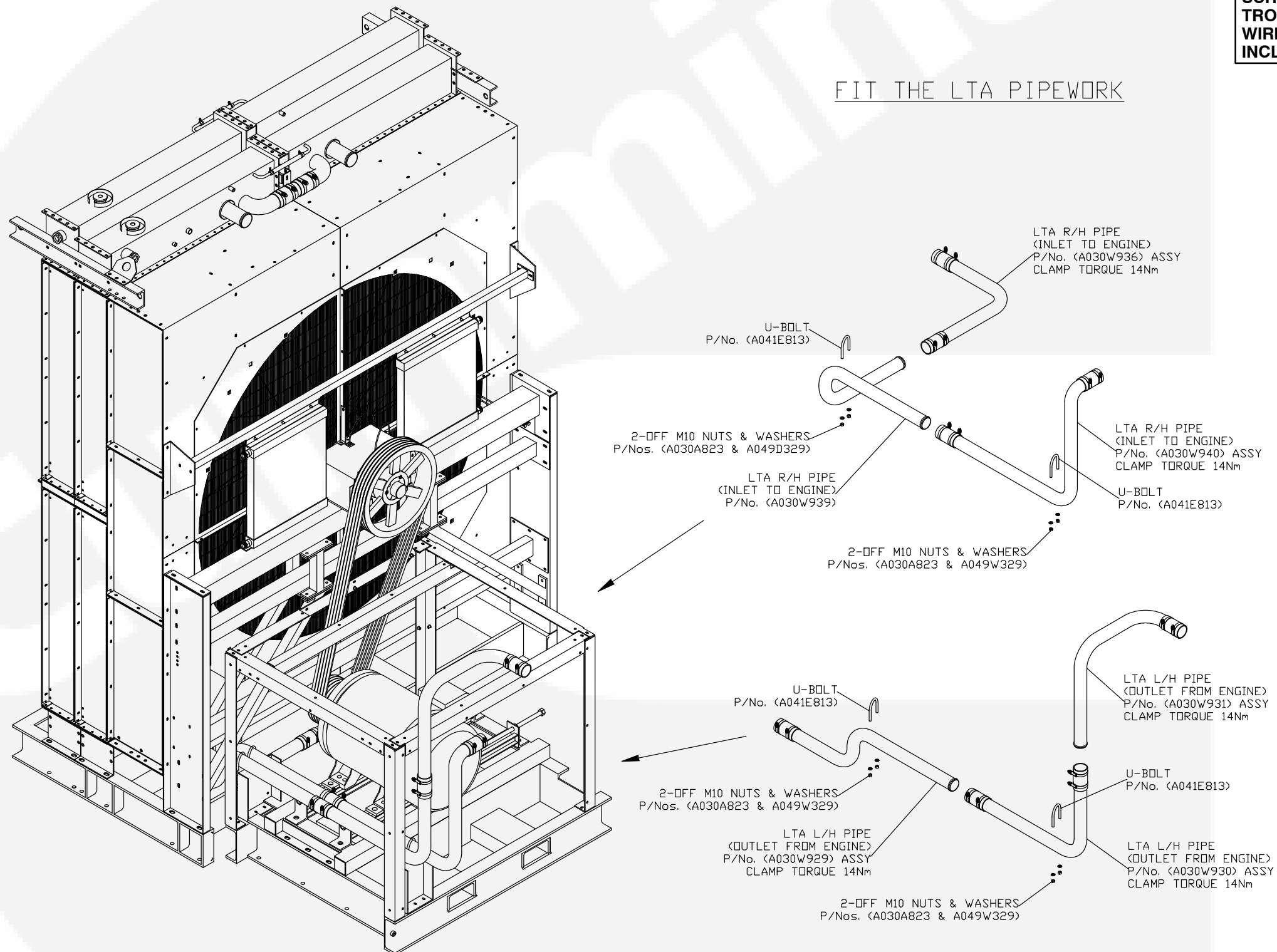
- a) ONCE THE BELTS ARE A SNUG FIT AROUND THE PULLEYS, SPIN THE PULLEYS 3-4 TIMES TO BED THE BELTS INTO THE GROOVES.
- b) ADJUST THE TENSIONER STUDDING RODS UNTIL THE INITIAL INSTALLATION SETTING FORCE FROM THE TABLE GIVES 16mm PER METRE OF BELT DEFLECTION (MEASURED IN THE CENTRE OF THE SPAN).
- c) RUN THE DRIVE FOR 15-20 MINUTES
- d) STOP THE DRIVE, CHECK THE TENSION AND RESET USING THE RETENSIONING SETTING FORCE FROM THE TABLE IF NECESSARY.



MOVE THE MOTOR BACK ALONG THE RAILS UNTIL THE BELTS ARE A SNUG FIT AROUND THE PULLEYS. THEN USE THE TENSIONER STUDDING TO INCREASE THE TENSION OF THE BELTS (SEE ABOVE FOR TENSION DETAILS)

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## FIT THE LTA PIPEWORK

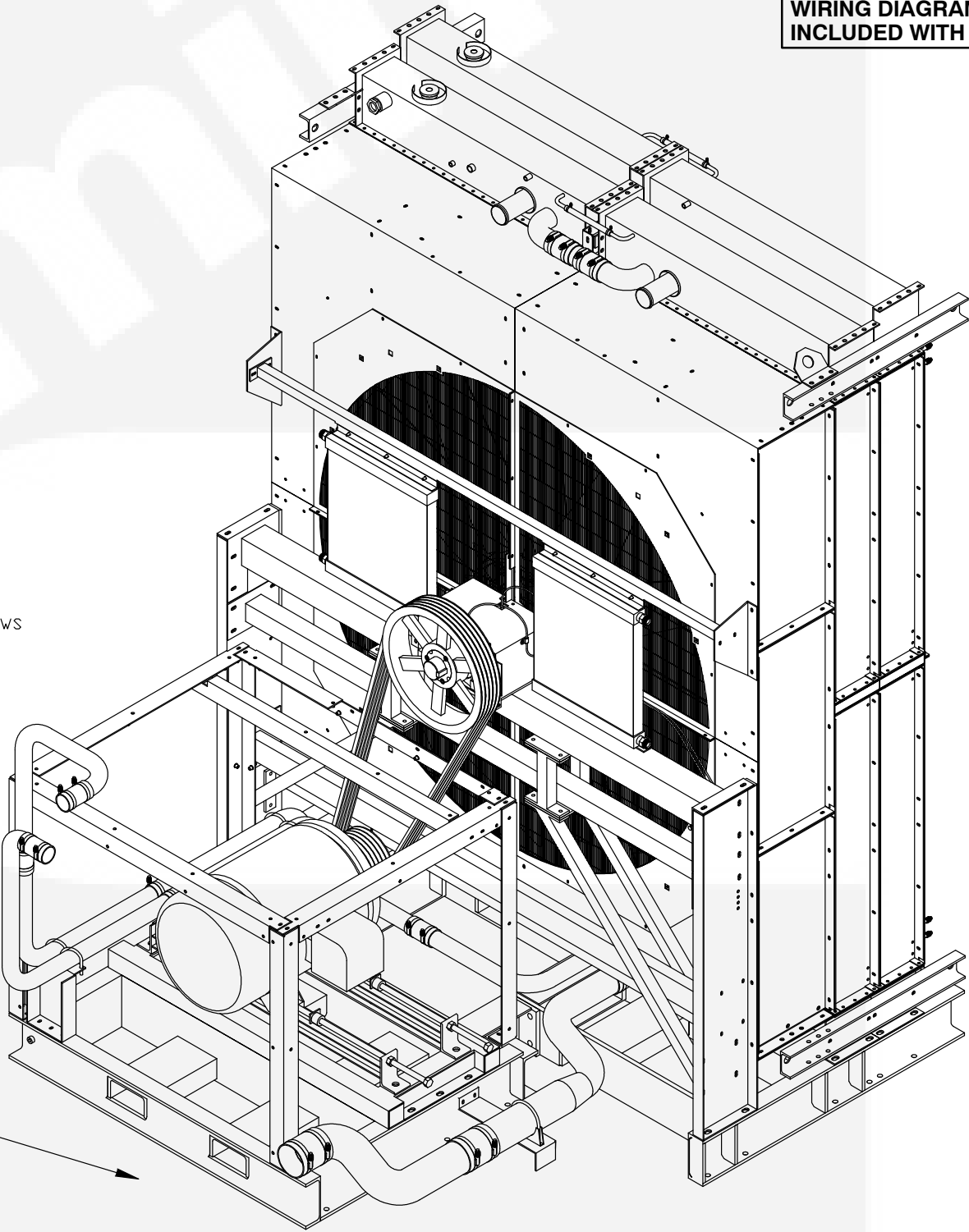
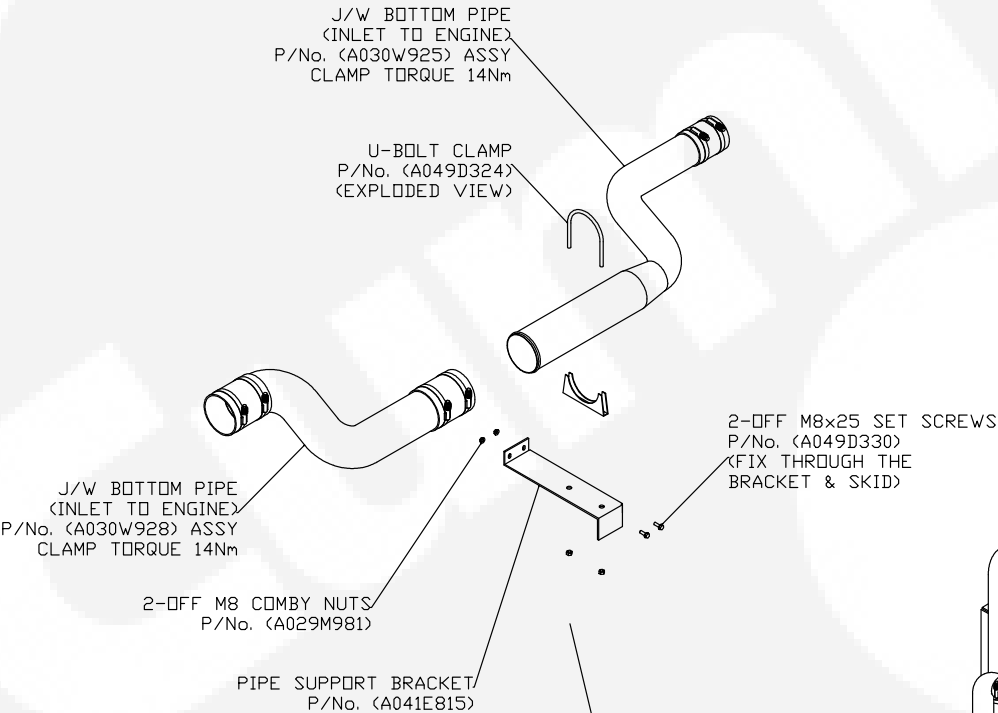


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COOLING SYSTEM INSTALLATION (40° C HIGH AMBIENT)

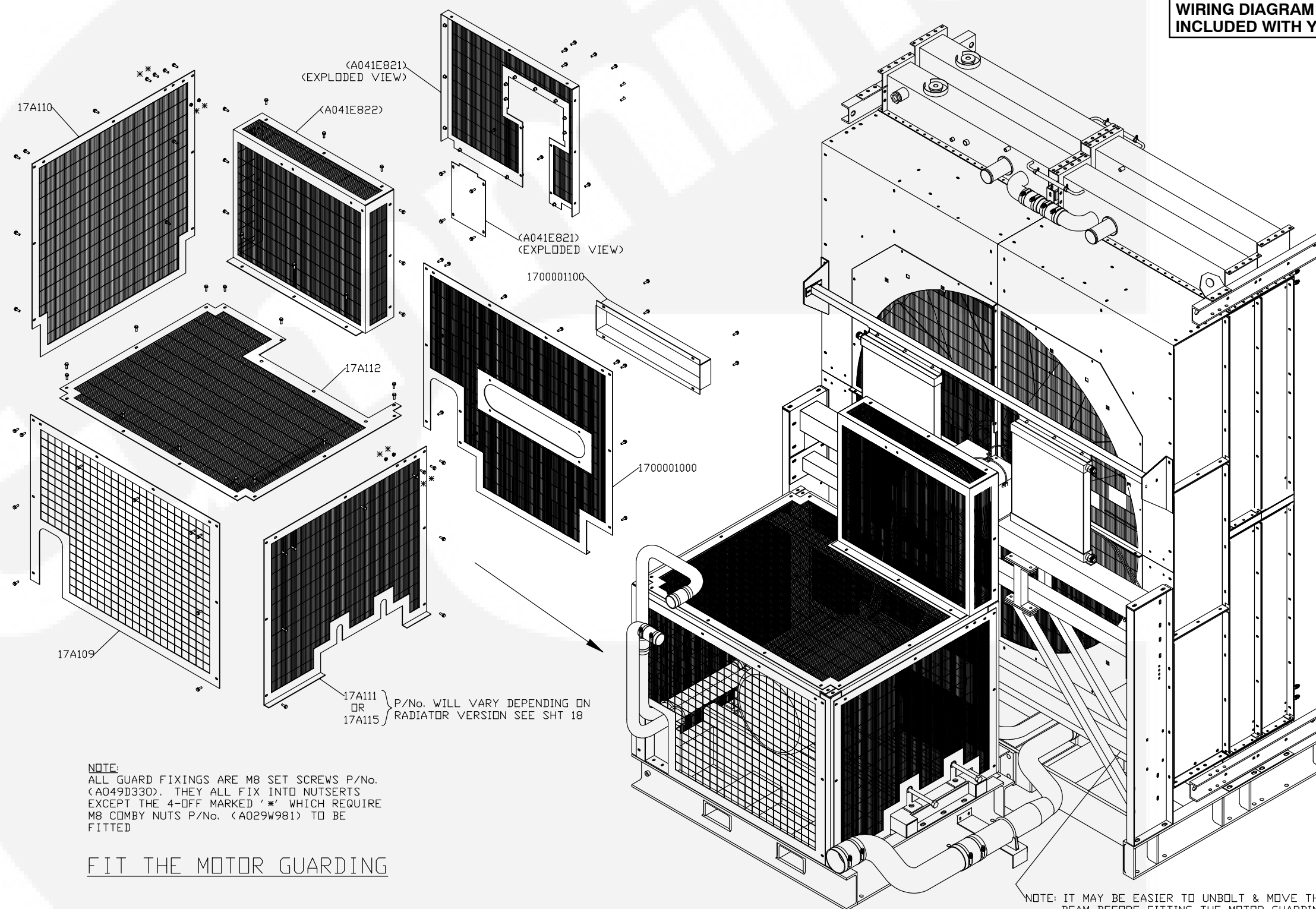
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

FIT THE J/W BOTTOM PIPEWORK



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NOTE:  
ALL GUARD FIXINGS ARE M8 SET SCREWS P/No. <A049D330>. THEY ALL FIX INTO NUTSERTS EXCEPT THE 4-OFF MARKED '✱' WHICH REQUIRE M8 COMBY NUTS P/No. <A029W981> TO BE FITTED

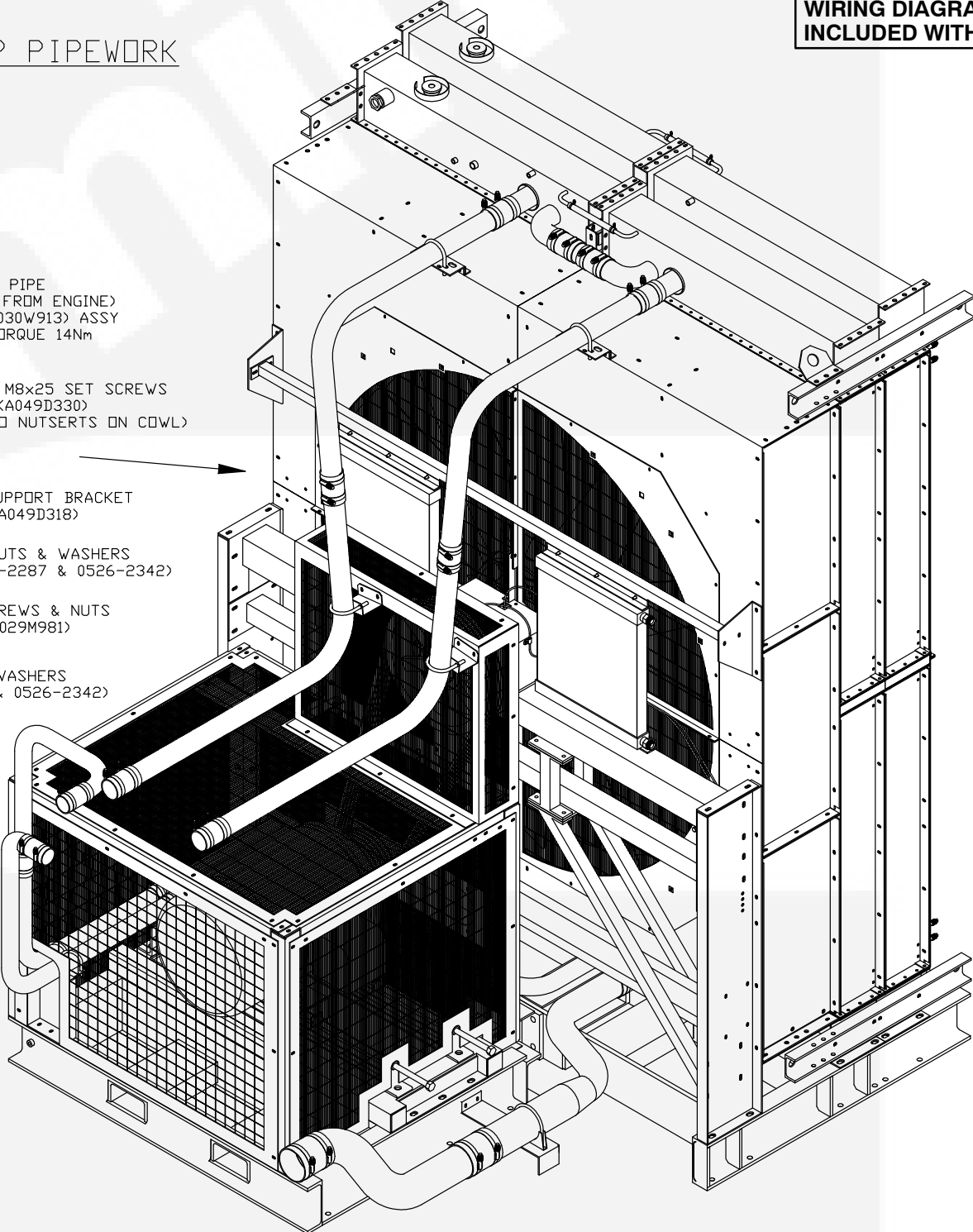
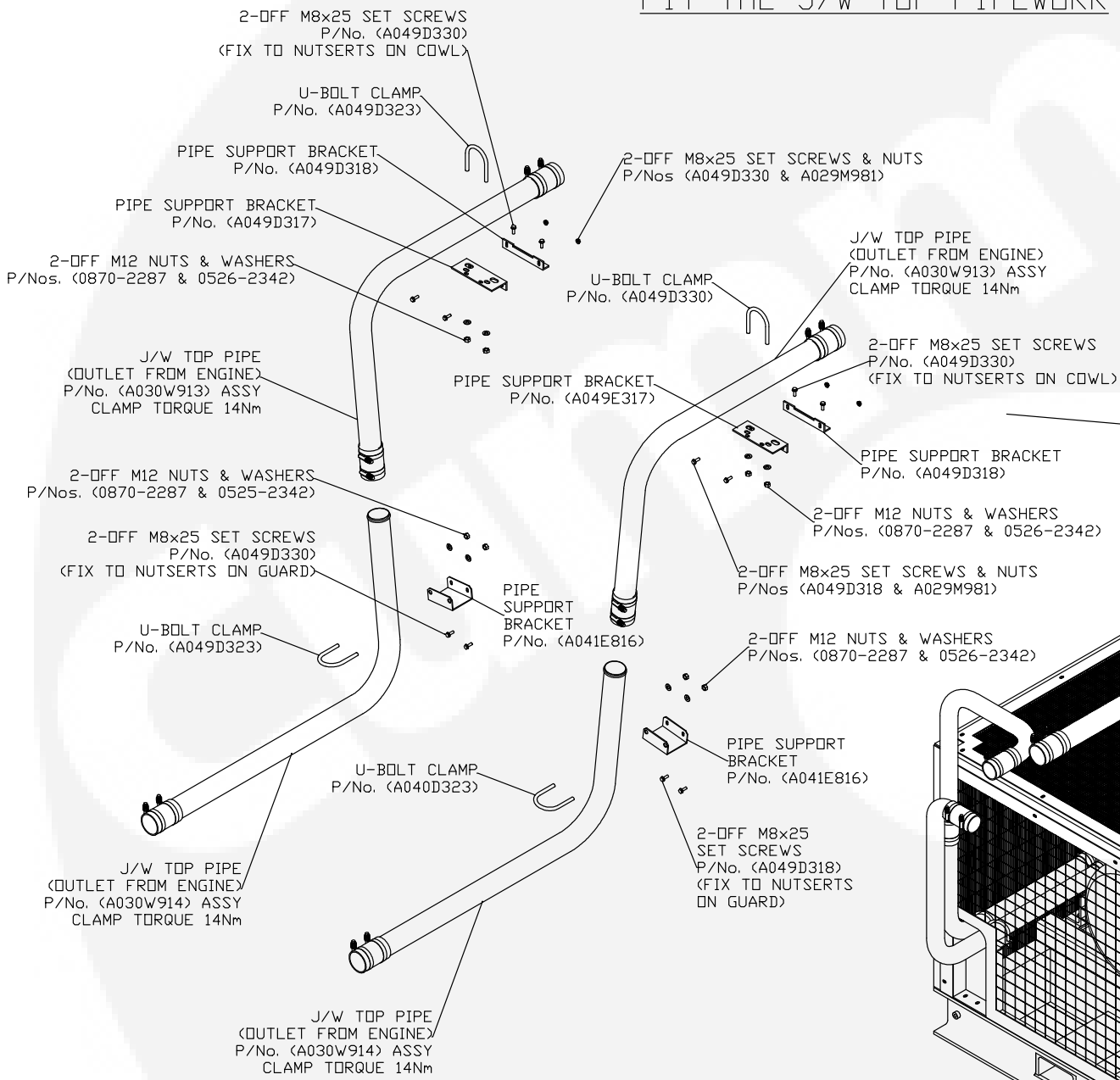
FIT THE MOTOR GUARDING

NOTE: IT MAY BE EASIER TO UNBOLT & MOVE THIS BEAM BEFORE FITTING THE MOTOR GUARDING.

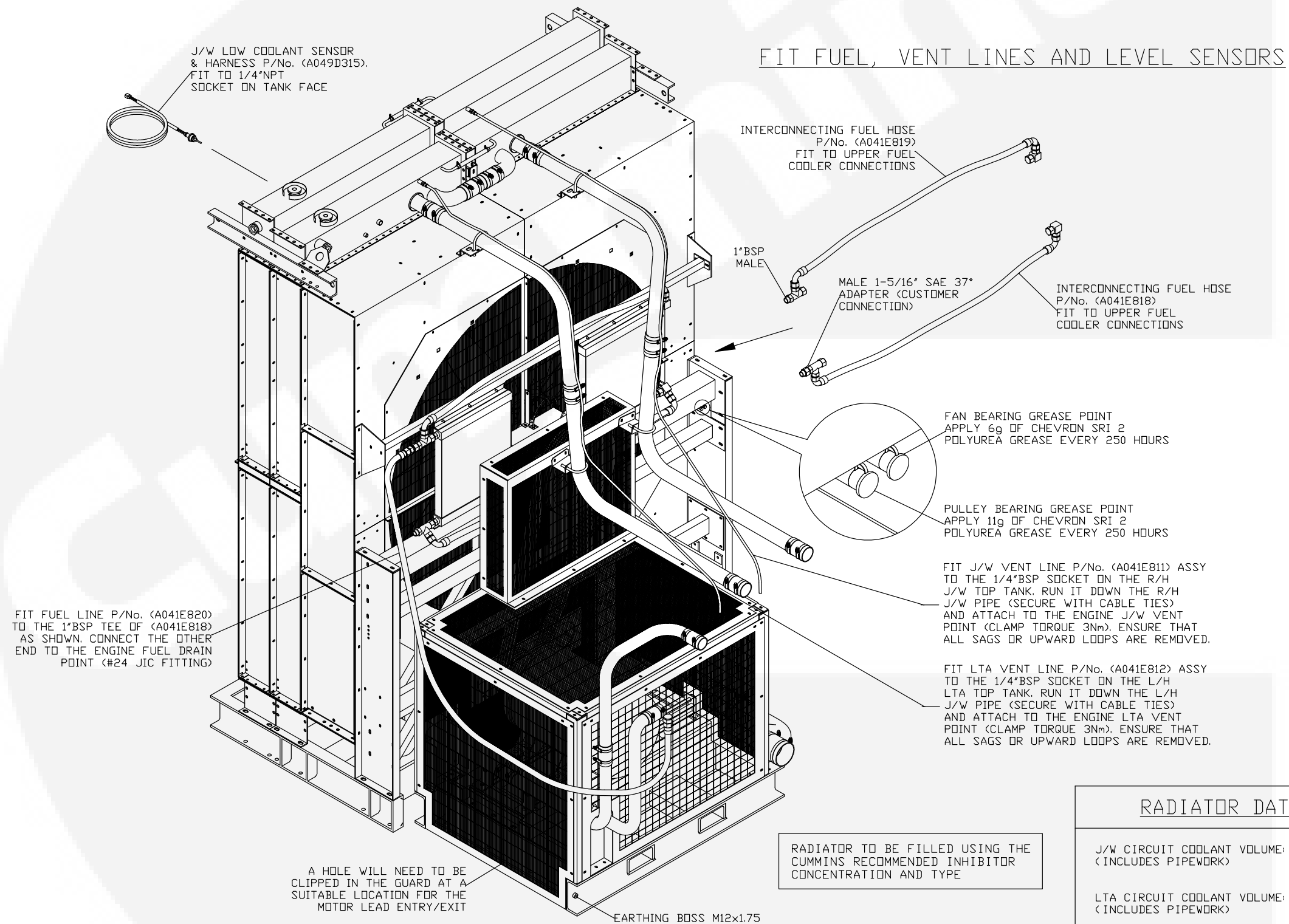
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FIT THE J/W TOP PIPEWORK



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RADIATOR VERSION DATA

RADIATOR VERSION	MOTOR DETAILS	MOTOR PULLEY & BELT (SEE SHT 2)	MOTOR GUARD OPTION (SEE SHT 15)																
60Hz RADIATOR (460V UL SPEC)	404/ST FRAME SIZE, 74.6KW 460V 3ph 60HZ NEMA DESIGN CODE B, KVA CODE G  MOTOR BEARING LUBRICATION: APPLY 4.1 inch OF POLYREX EM (EXXON MOBILE) GREASE EVERY 1750 HOURS	<table><tr><th>#</th><th>Component</th><th>QTY</th><th>Description</th></tr><tr><td>38</td><td>(A049D332)</td><td>1.000</td><td>MATCHED BELT SET (5-OFF SPB 3550LG)</td></tr><tr><td>39</td><td>(A049D333)</td><td>1.000</td><td>PULLEY SPB 5G 250mm PCD</td></tr><tr><td>40</td><td>(A049D334)</td><td>1.000</td><td>TAPERLOCK BUSH 2-7/8" BORE</td></tr></table>	#	Component	QTY	Description	38	(A049D332)	1.000	MATCHED BELT SET (5-OFF SPB 3550LG)	39	(A049D333)	1.000	PULLEY SPB 5G 250mm PCD	40	(A049D334)	1.000	TAPERLOCK BUSH 2-7/8" BORE	17A115
#	Component	QTY	Description																
38	(A049D332)	1.000	MATCHED BELT SET (5-OFF SPB 3550LG)																
39	(A049D333)	1.000	PULLEY SPB 5G 250mm PCD																
40	(A049D334)	1.000	TAPERLOCK BUSH 2-7/8" BORE																
60Hz RADIATOR (380V UL SPEC)	404/ST FRAME SIZE, 74.6KW 380V 3ph 60HZ NEMA DESIGN CODE B, KVA CODE G  MOTOR BEARING LUBRICATION: APPLY 4.1 inch OF POLYREX EM (EXXON MOBILE) GREASE EVERY 1750 HOURS	<table><tr><th>#</th><th>Component</th><th>QTY</th><th>Description</th></tr><tr><td>38</td><td>(A049D332)</td><td>1.000</td><td>MATCHED BELT SET (5-OFF SPB 3550LG)</td></tr><tr><td>39</td><td>(A049D333)</td><td>1.000</td><td>PULLEY SPB 5G 250mm PCD</td></tr><tr><td>40</td><td>(A049D334)</td><td>1.000</td><td>TAPERLOCK BUSH 2-7/8" BORE</td></tr></table>	#	Component	QTY	Description	38	(A049D332)	1.000	MATCHED BELT SET (5-OFF SPB 3550LG)	39	(A049D333)	1.000	PULLEY SPB 5G 250mm PCD	40	(A049D334)	1.000	TAPERLOCK BUSH 2-7/8" BORE	17A115
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40	(A049D334)	1.000	TAPERLOCK BUSH 2-7/8" BORE																
60Hz RADIATOR (460V)	TBC	TBC	TBC																
60Hz RADIATOR (380V)	TBC	TBC	TBC																
50Hz RADIATOR	280SM FRAME SIZE, 75KW 400V 3ph 50HZ IP55 INSULATION CLASS F  MOTOR BEARING LUBRICATION: TBC	<table><tr><th>#</th><th>Component</th><th>QTY</th><th>Description</th></tr><tr><td>38</td><td>(A049E332)</td><td>1.000</td><td>MATCHED BELT SET (5-OFF SPB 3550LG)</td></tr><tr><td>39</td><td>(A041E817)</td><td>1.000</td><td>PULLEY SPB 5G 300mm PCD</td></tr><tr><td>40</td><td>(A049D335)</td><td>1.000</td><td>TAPERLOCK BUSH 3525 75MM BORE</td></tr></table>	#	Component	QTY	Description	38	(A049E332)	1.000	MATCHED BELT SET (5-OFF SPB 3550LG)	39	(A041E817)	1.000	PULLEY SPB 5G 300mm PCD	40	(A049D335)	1.000	TAPERLOCK BUSH 3525 75MM BORE	17A111
#	Component	QTY	Description																
38	(A049E332)	1.000	MATCHED BELT SET (5-OFF SPB 3550LG)																
39	(A041E817)	1.000	PULLEY SPB 5G 300mm PCD																
40	(A049D335)	1.000	TAPERLOCK BUSH 3525 75MM BORE																

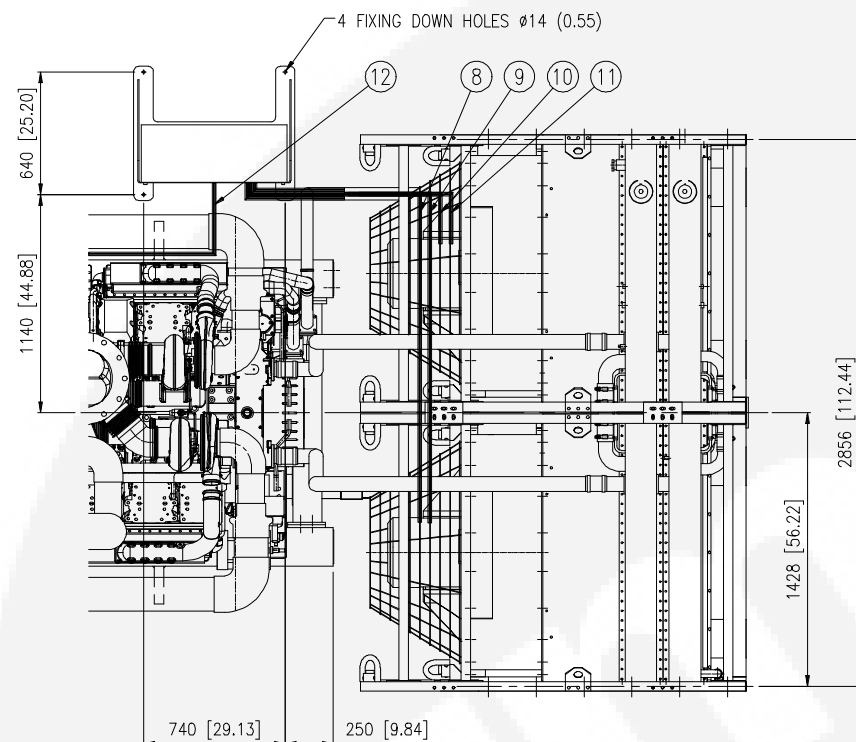
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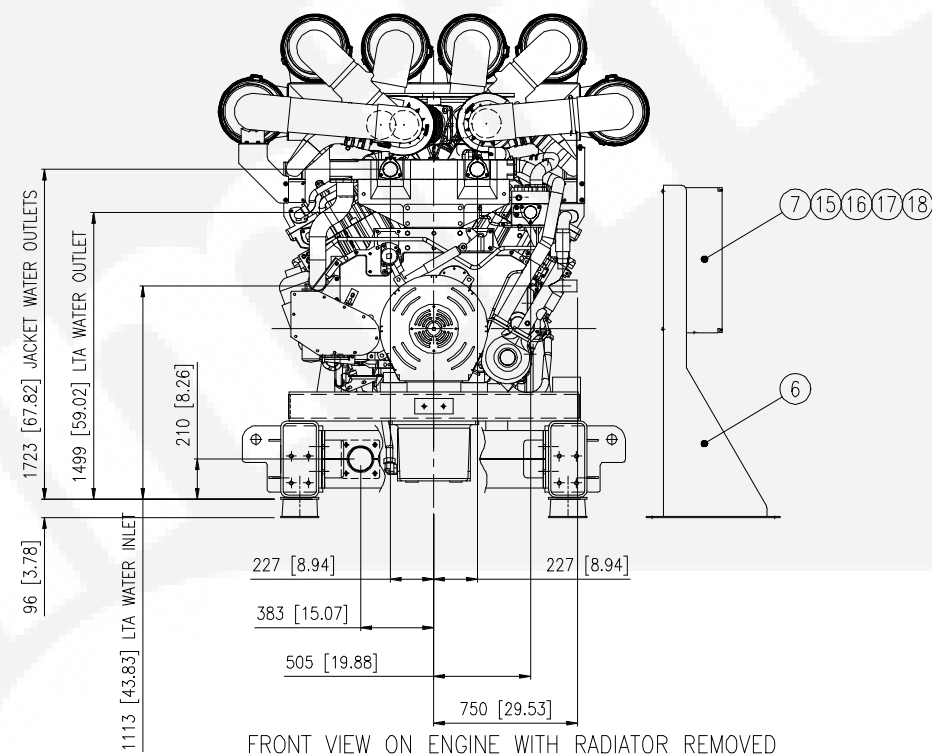
ITEM	QTY	PART NO.	DESCRIPTION
1	1	0130-5997-01	RADIATOR (50C)
2	1	0130-5997-02	RADIATOR (50C)
3	1	0130-5997-03	RADIATOR (50C)
4	1	0130-5997-04	RADIATOR (50C)
5	1	0130-5997-05	RADIATOR (50C)
6	1	0319-5235-02	FRAME-CABINET
7	1	0300-5819	CONTROL ASSY (RADIATOR)
8	1	0338-4402	HARNESS-POWER
9	1	0338-4407	HARNESS-CONTROL
10	1	0501-0811	HOSE ASSY (1"BSPTX1-1/2"BSP 90DEG FM/FM/)
11	1	0505-2161-02	ADAPTER-PIPE (1" BSPTX1-1/2"NPT M/M)
12	4	0800-3017-20	SCREW-HEX HD M8 X 25 LONG
13	4	0862-0026-55	NUT-HEX (REG STL)
14	8	0526-0399-60	WASHER-FL
15	4	0850-0114-54	WASHER-LOCK SPRING M8 716370
16	0.1	0524-0826	SEALANT-THREAD
17	4	0098-8094	LABEL-WARNING (PRESS LIQUID)
18	4	0098-8095	LABEL-WARNING (HOT SURFACE)
19	2	0098-8104-01	LABEL-WARNING (VARIOUS VOLTAGES)
20	4	0098-8104-04	LABEL-WARNING (VARIOUS VOLTAGES)
21	2	0098-8104-05	LABEL-WARNING
22	2	0098-8106	LABEL-INFORMATION (TAG-WATER FILL)
23	2	0098-8130	LABEL-CAUTION (ROTATING PARTS)
24	1	0338-3832	HARNESS-LCL

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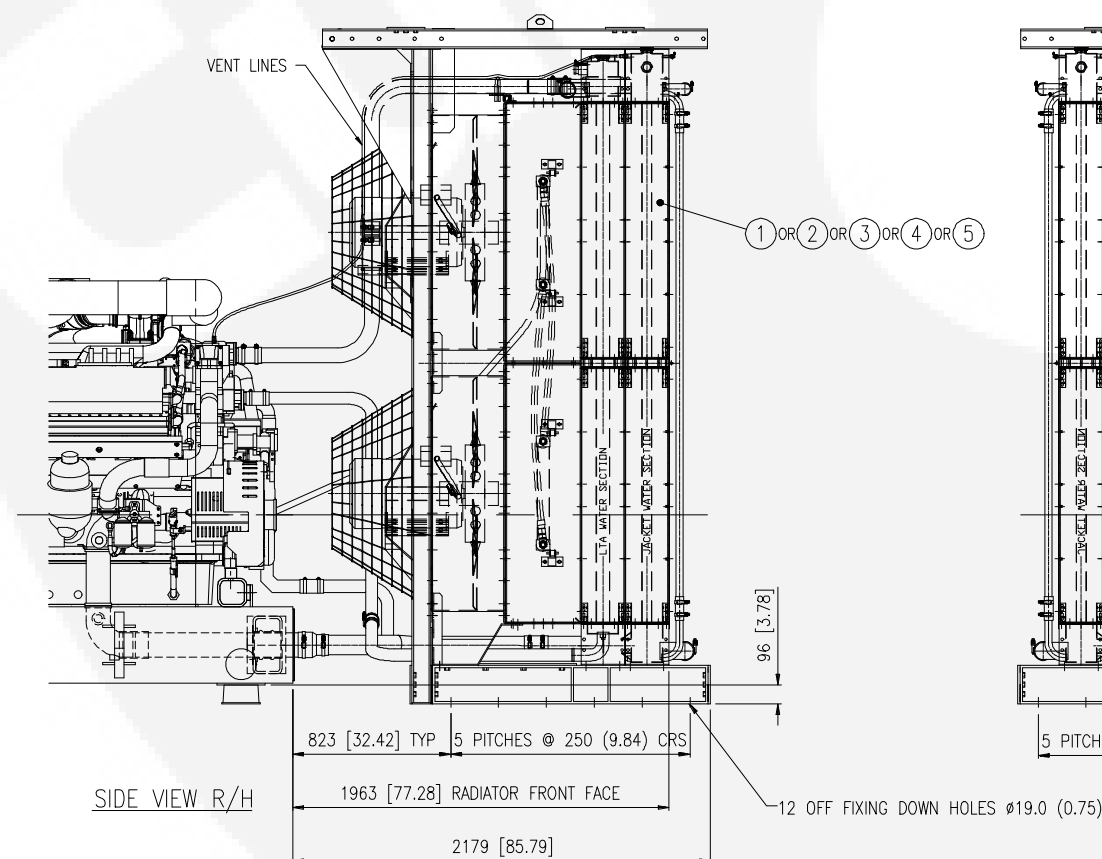
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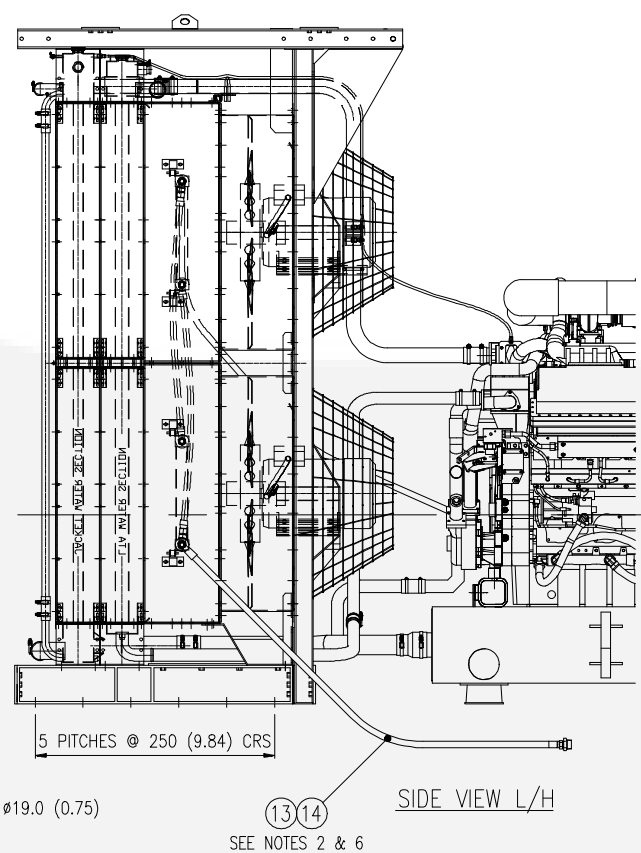
PLAN VIEW



FRONT VIEW ON ENGINE WITH RADIATOR REMOVED



SIDE VIEW R/H



SIDE VIEW L/H

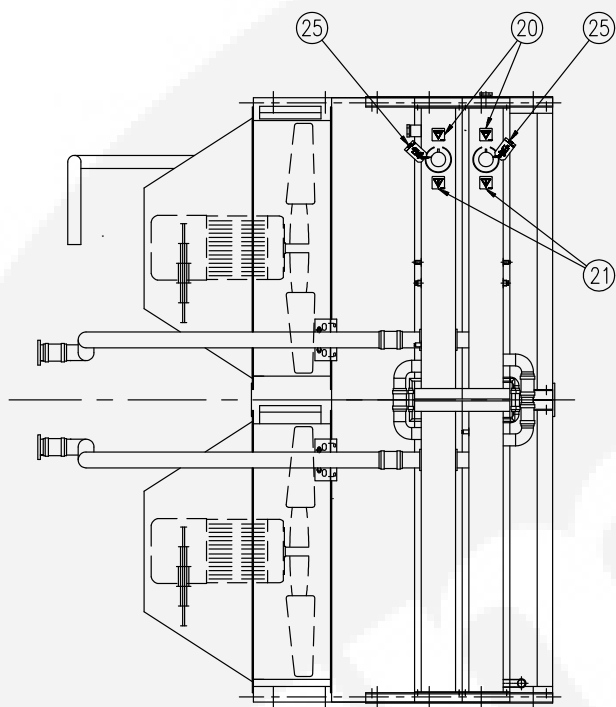
NOTES:

1. DIMENSIONS SHOWN IN ( ) BRACKETS ARE IN INCHES.
2. APPLY PIPE SEALANT (ITEM 19) TO ALL PIPE THREAD CONNECTIONS.
3. TORQUE HOSE CLAMPS TO 50 ±5 IN LBS
4. LOCATE ALL LABELS IN APPROXIMATE POSITIONS AS SHOWN ON SHEET 2
5. FOR WIRING DETAILS SEE SHT 3 OF THIS DRAWING.
6. FUEL HOSE ASSY & ADAPTER PIPE (ITEMS 10 & 11) TO BE REMOVED FROM ENGINE FUEL RETURN & FITTED TO RADIATOR FUEL COOLER, AS SHOWN.
7. BEARWARD SUPPLIED FUEL COOLER HOSES TO BE CONNECTED IN SERIES.
8. RADIATOR UNDERFRAME SPACER PLATES TO BE USED WHEN ALTERNATIVE HEIGHT ANTI-VIBRATION MOUNTS ARE EMPLOYED.
9. NOMINAL WEIGHT BASED ON SUPPLIER DATA: (DRY-3690 kg WET-4200 kg) NOT FOR INSPECTION.

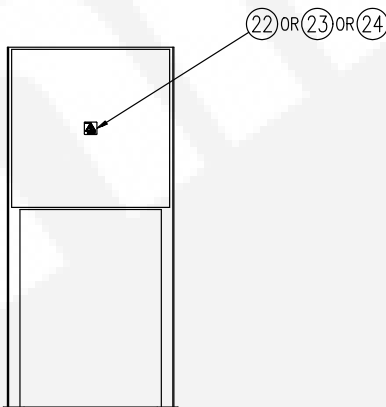
TABULATION			
PART NO.	VOLTAGES	Hz	CURRENT ER No.
0179-3302-01	380V-440V	50	ERK9466
0179-3302-02	380V	60	ERK9466
0179-3302-03	416V-480V	60	ERK9466
0179-3302-04	380V UL NEMA	60	ERK9466
0179-3302-05	416V-480V UL NEMA	60	ERK9466

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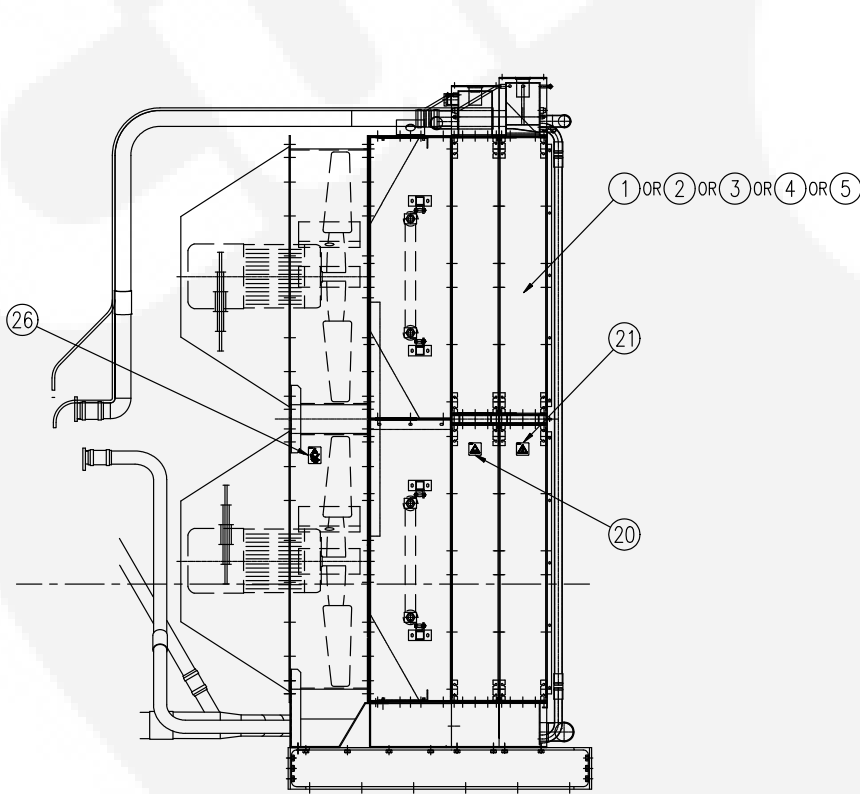
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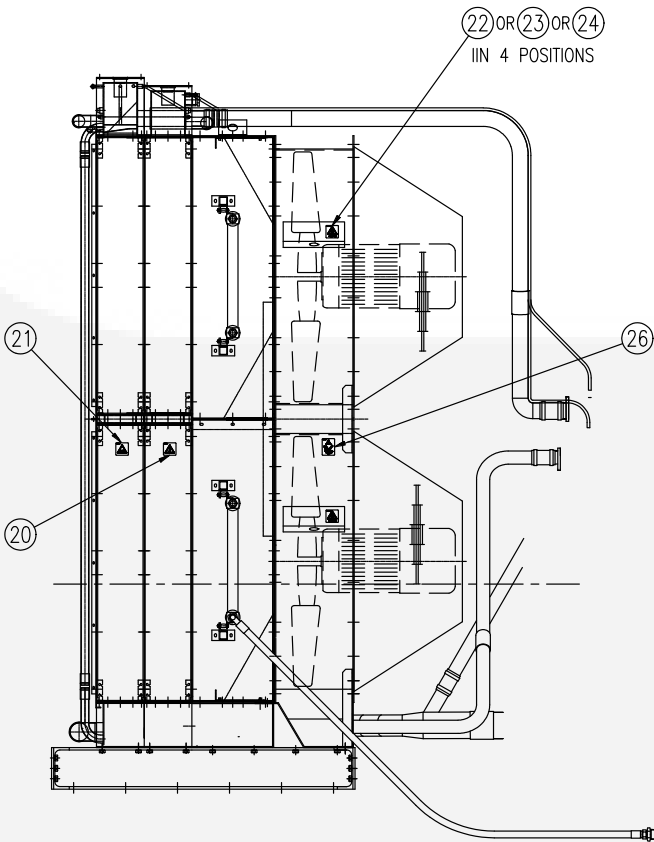
PLAN VIEW



CONTROL ASSY (ITEM 7)



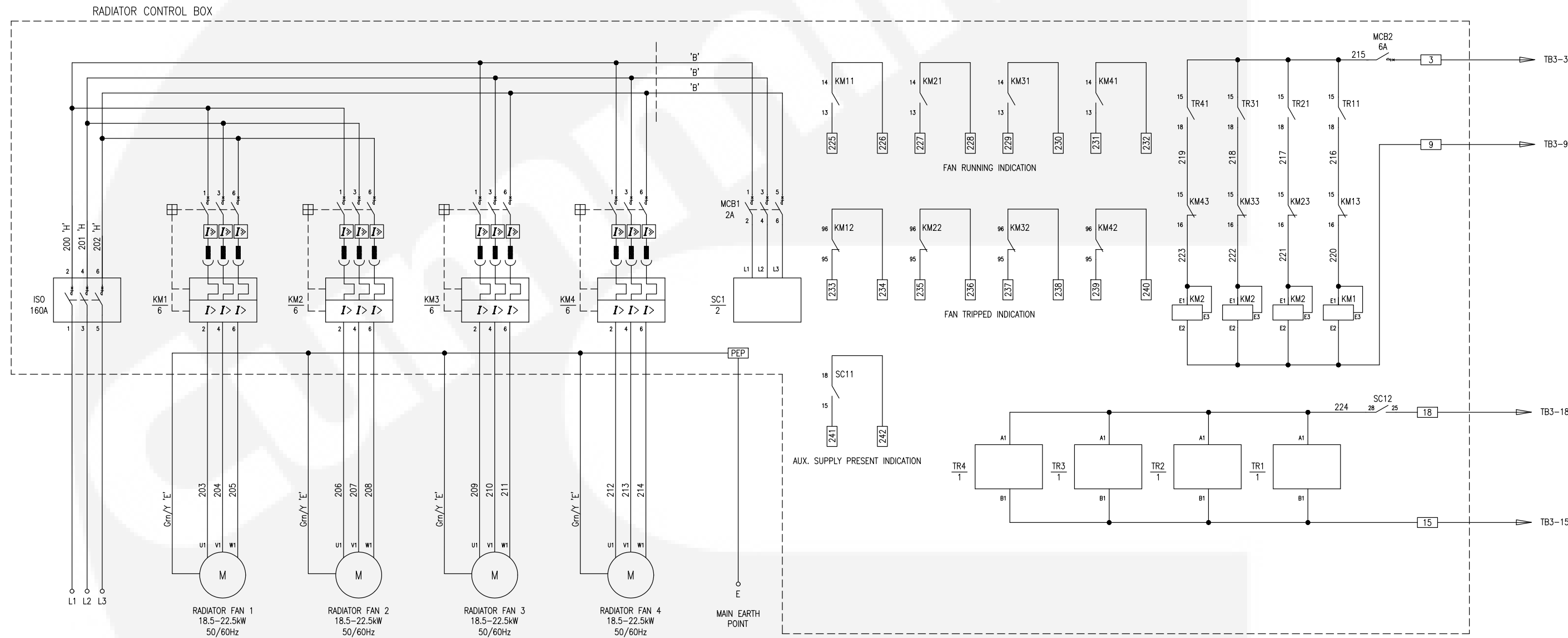
SIDE VIEW R/H



SIDE VIEW L/H

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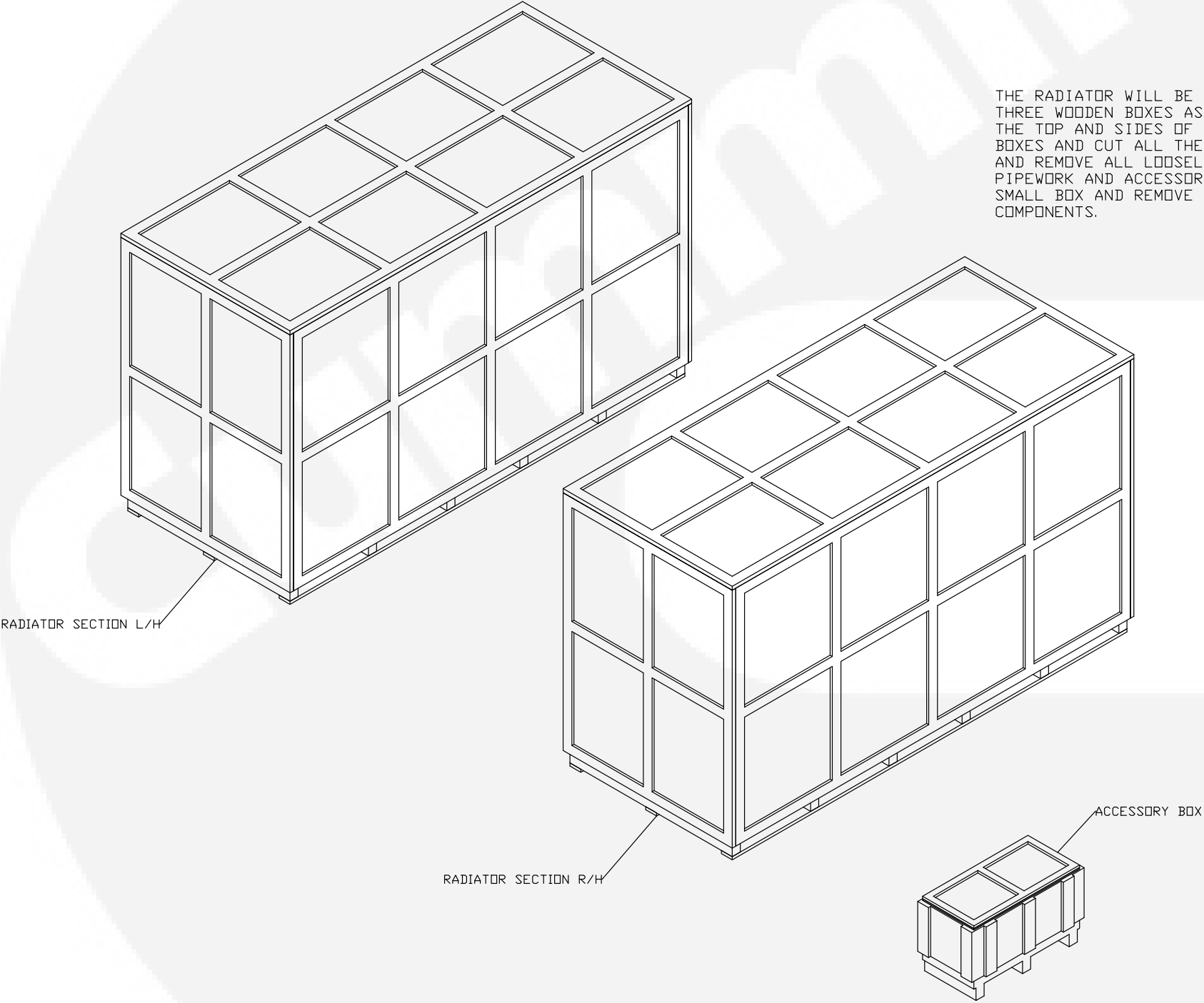


NOTES:

1. TIMER SETTINGS:  
TR1: 3 sec  
TR2: 6 sec  
TR3: 9 sec  
TR4: 12 sec

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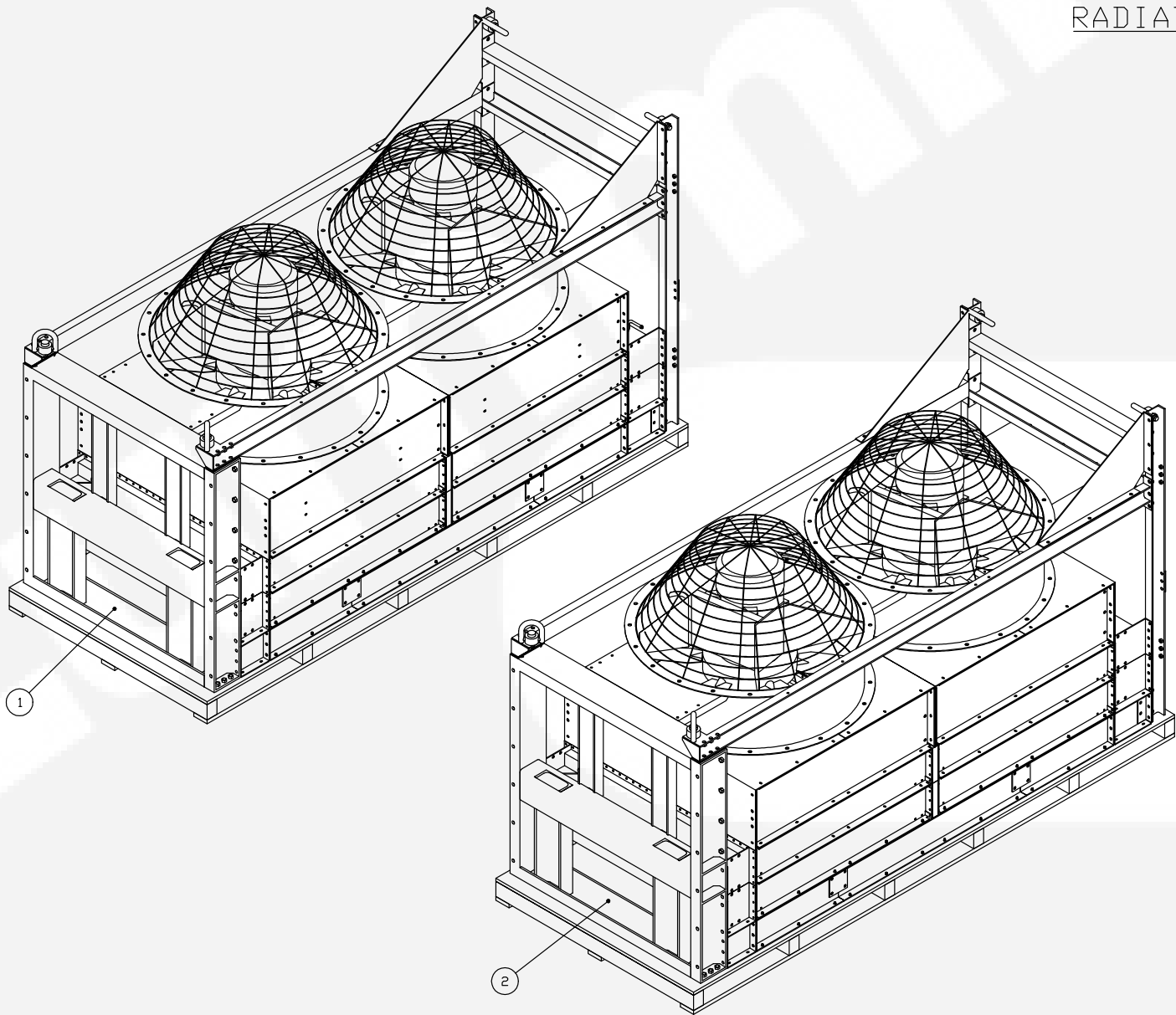


THE RADIATOR WILL BE SHIPPED IN THREE WOODEN BOXES AS SHOWN. REMOVE THE TOP AND SIDES OF THE LARGE BOXES AND CUT ALL THE CABLE TIES AND REMOVE ALL LOOSELY ATTACHED PIPEWORK AND ACCESSORIES. OPEN THE SMALL BOX AND REMOVE THE COMPONENTS.

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RADIATOR SECTIONS

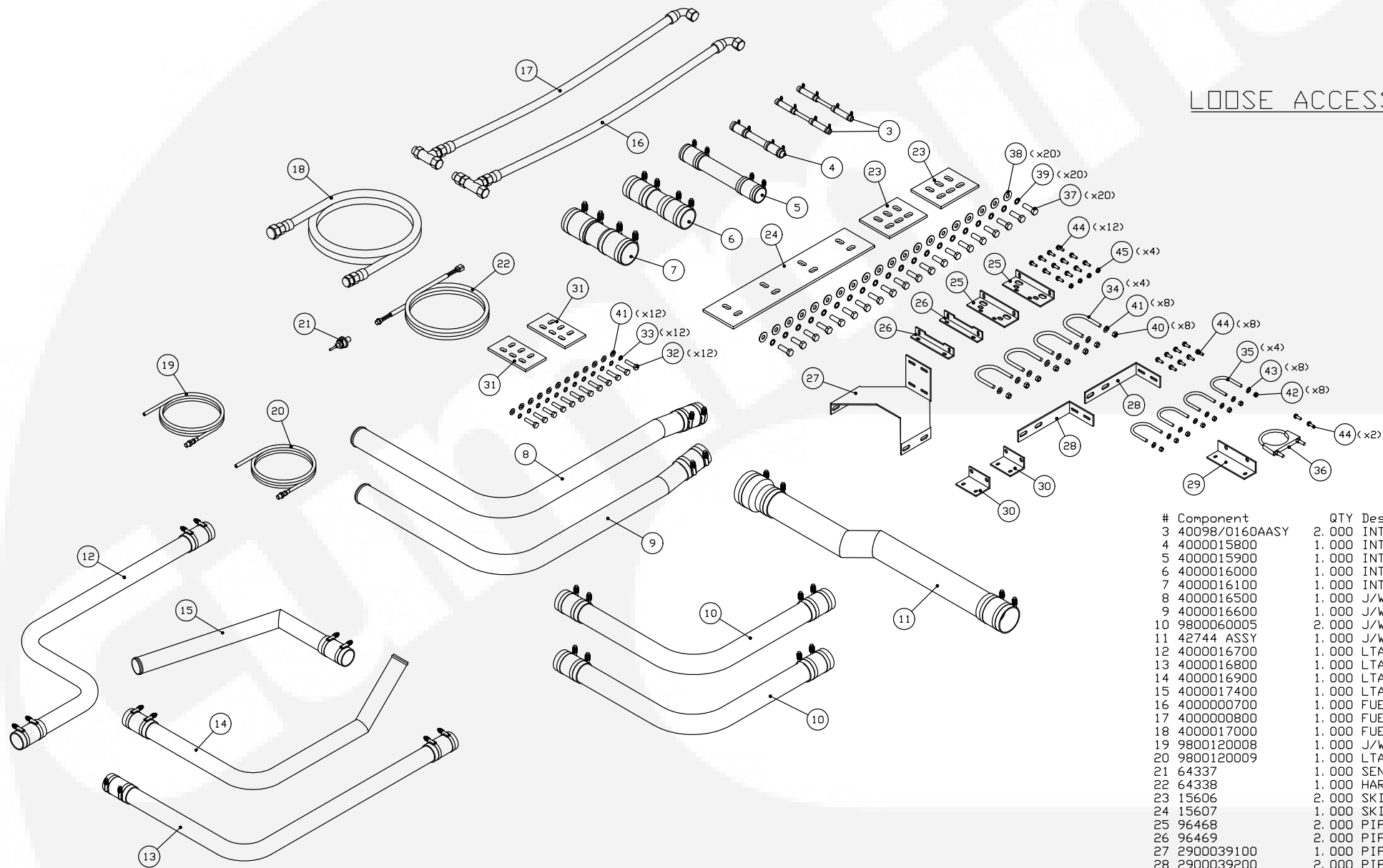


#	Component	QTY	Description
1	A050L782	1.000	RADIATOR L/H
2	A050L783	1.000	RADIATOR R/H
<SEE sht 3 FOR REMAINING COMPONENTS>			

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LOOSE ACCESSORIES



# Component	QTY	Description
3 40098/0160AASY	2.000	INT CONNECTING PIPE ASSY
4 4000015800	1.000	INT CONNECTING PIPE ASSY
5 4000015900	1.000	INT CONNECTING PIPE ASSY
6 4000016000	1.000	INT CONNECTING PIPE ASSY
7 4000016100	1.000	INT CONNECTING PIPE ASSY
8 4000016500	1.000	J/W TOP PIPE L/H ASSY
9 4000016600	1.000	J/W TOP PIPE R/H ASSY
10 9800060005	2.000	J/W TOP PIPE ASSY
11 42744 ASSY	1.000	J/W BOTTOM PIPE ASSEMBLY
12 4000016700	1.000	LTA BOTTOM PIPE L/H ASSY
13 4000016800	1.000	LTA BOTTOM PIPE R/H ASSY
14 4000016900	1.000	LTA BOTTOM PIPE R/H ASSY
15 4000017400	1.000	LTA BOTTOM PIPE R/H ASSY
16 4000000700	1.000	FUEL LINE 1" DIA (INLET)
17 4000000800	1.000	FUEL LINE 1" DIA (OUTLET)
18 4000017000	1.000	FUEL LINE 1" DIA (TO ENGINE)
19 9800120008	1.000	J/W VENT LINE 1/4"
20 9800120009	1.000	LTA VENT LINE 1/4"
21 64337	1.000	SENDER-LOW COOLANT LEVEL
22 64338	1.000	HARNESS 0338-3832
23 15606	2.000	SKID FIXING PLATE
24 15607	1.000	SKID FIXING PLATE
25 96468	2.000	PIPE SUPPORT BRACKET
26 96469	2.000	PIPE SUPPORT BRACKET
27 2900039100	1.000	PIPE SUPPORT BRACKET
28 2900039200	2.000	PIPE SUPPORT BRACKET
29 2900039300	1.000	PIPE SUPPORT BRACKET
30 2900039400	2.000	PIPE SUPPORT BRACKET
31 1500003000	2.000	FRAME FIXING PLATE
32 33169	12.000	M12X50 BOLT
33 33420	12.000	M12 S/C SPRING WASHER
34 64102/65	4.000	U-BOLT (NOT TO GRIP)
35 64102/50	4.000	U-BOLT (NOT TO GRIP)
36 64430	1.000	U-BOLT CLAMP 4"
37 33175	20.000	M16X50 BOLT
38 33308016	20.000	M16 FLAT WASHER
39 33425	20.000	M16 S/C SPRING WASHER
40 33037	8.000	M12 NYLOC NUT
41 33308012	20.000	M12 FLAT WASHER
42 33033	8.000	M10 NYLOC NUT
43 33308010	8.000	M10 FLAT WASHER
44 33610/8X25	22.000	M8X25-GR8, 8-F/W17MM
45 33010	4.000	M8 CDMBY NUT

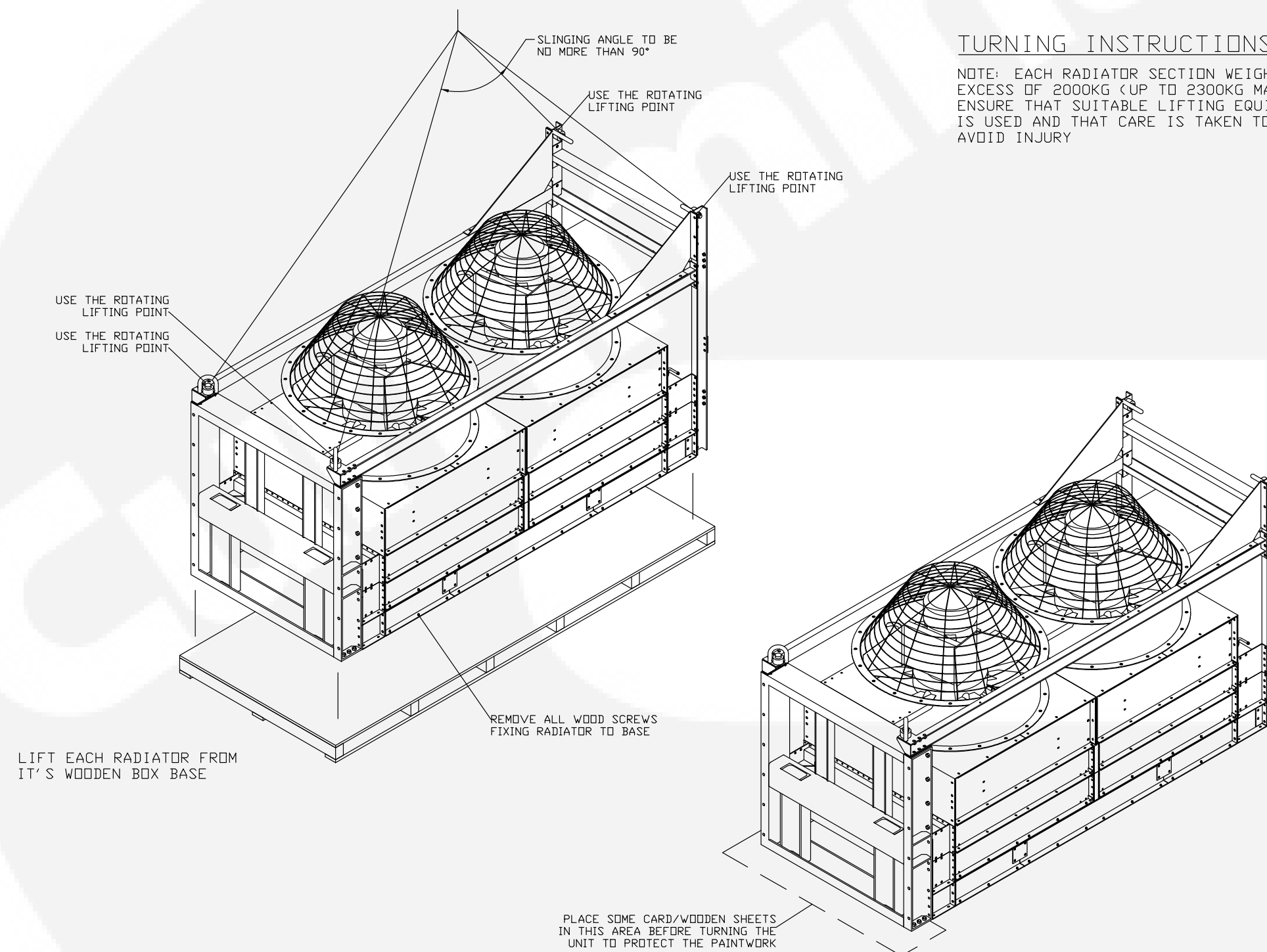
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Modified 1-2015



THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

## TURNING INSTRUCTIONS 1

NOTE: EACH RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UP TO 2300KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY

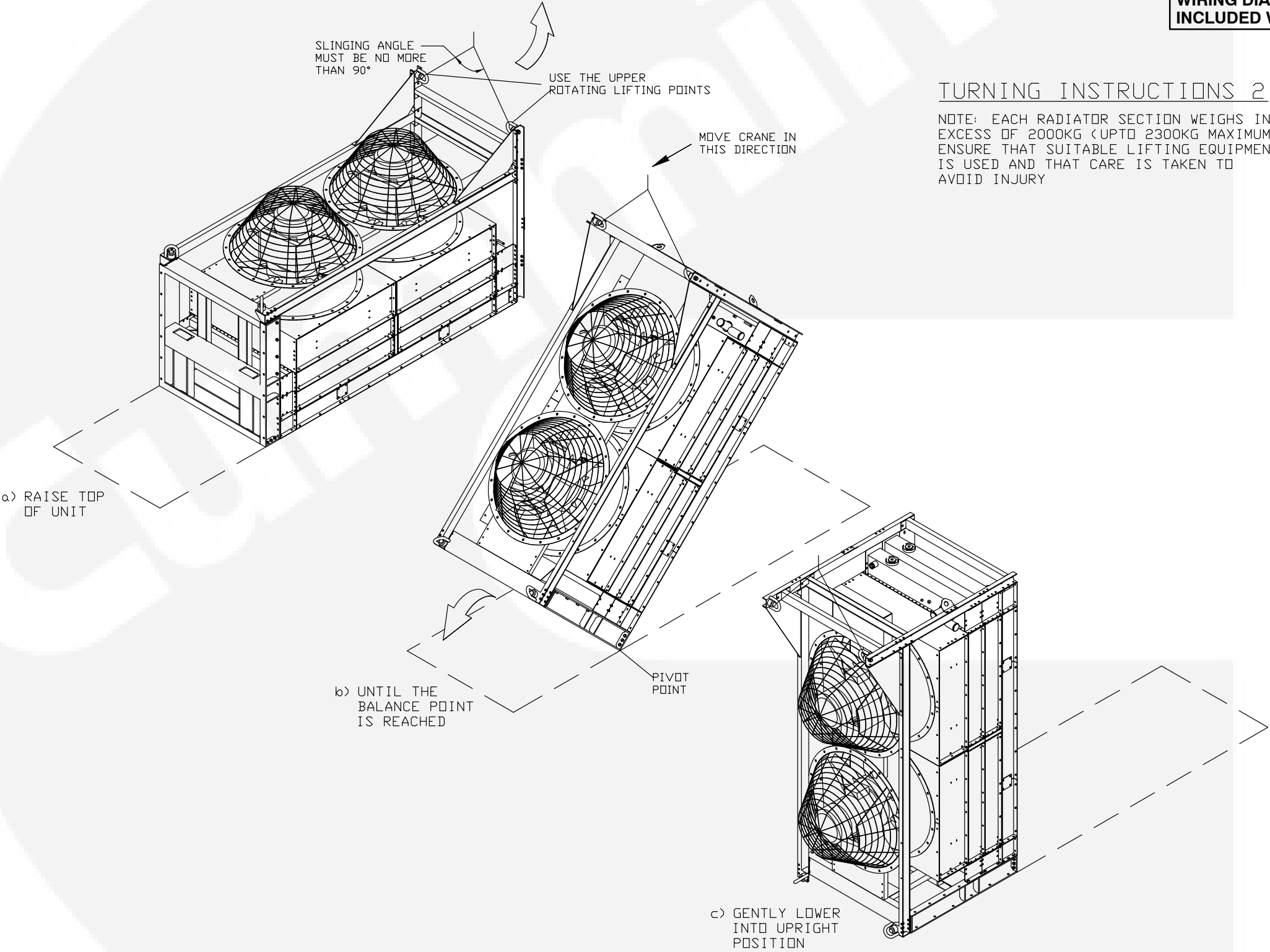


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THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

TURNING INSTRUCTIONS 2

NOTE: EACH RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UPTO 2300KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY

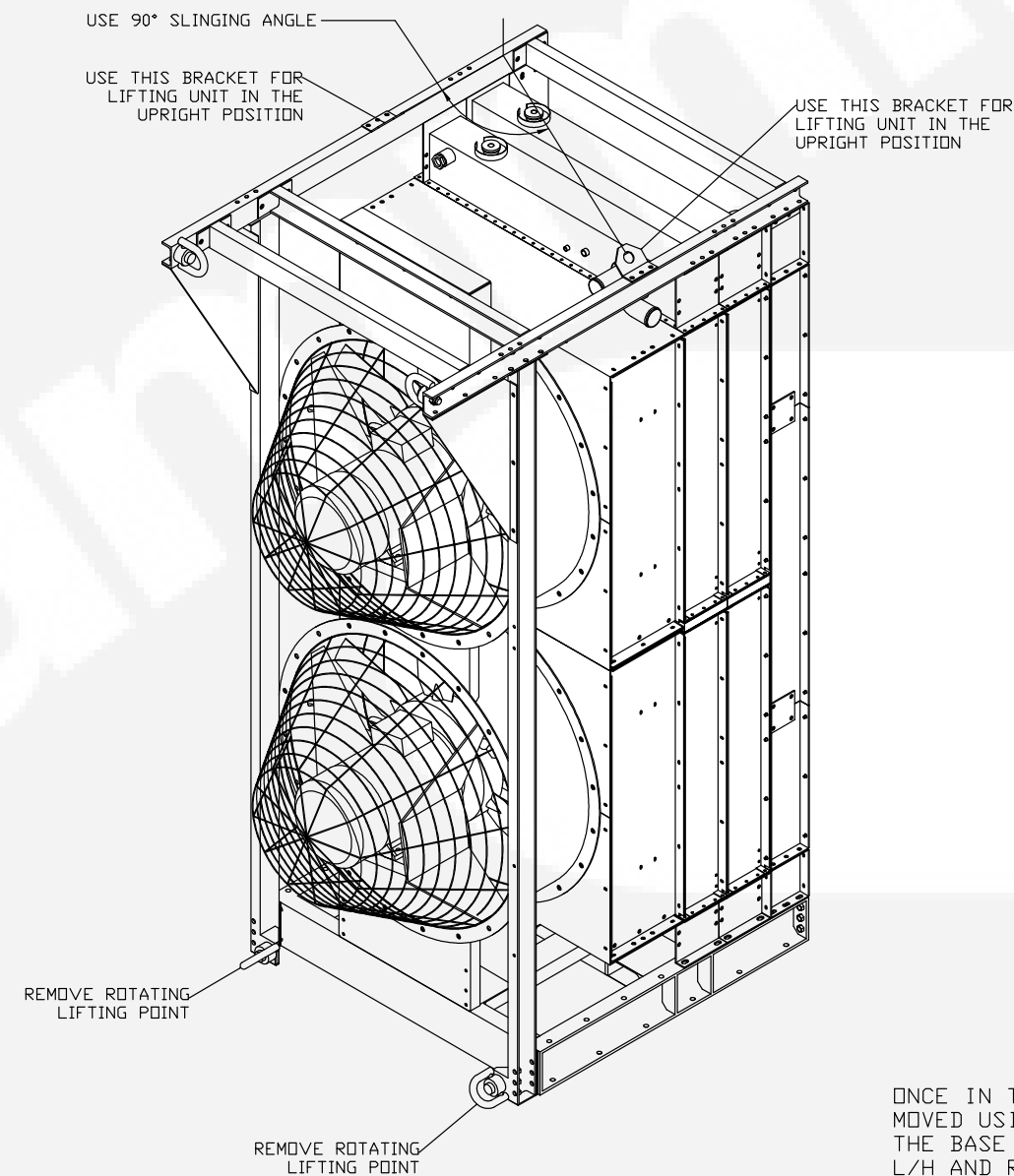


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### TURNING INSTRUCTIONS 3

NOTE: EACH RADIATOR SECTION WEIGHS IN EXCESS OF 2000KG (UPTO 2300KG MAXIMUM) ENSURE THAT SUITABLE LIFTING EQUIPMENT IS USED AND THAT CARE IS TAKEN TO AVOID INJURY



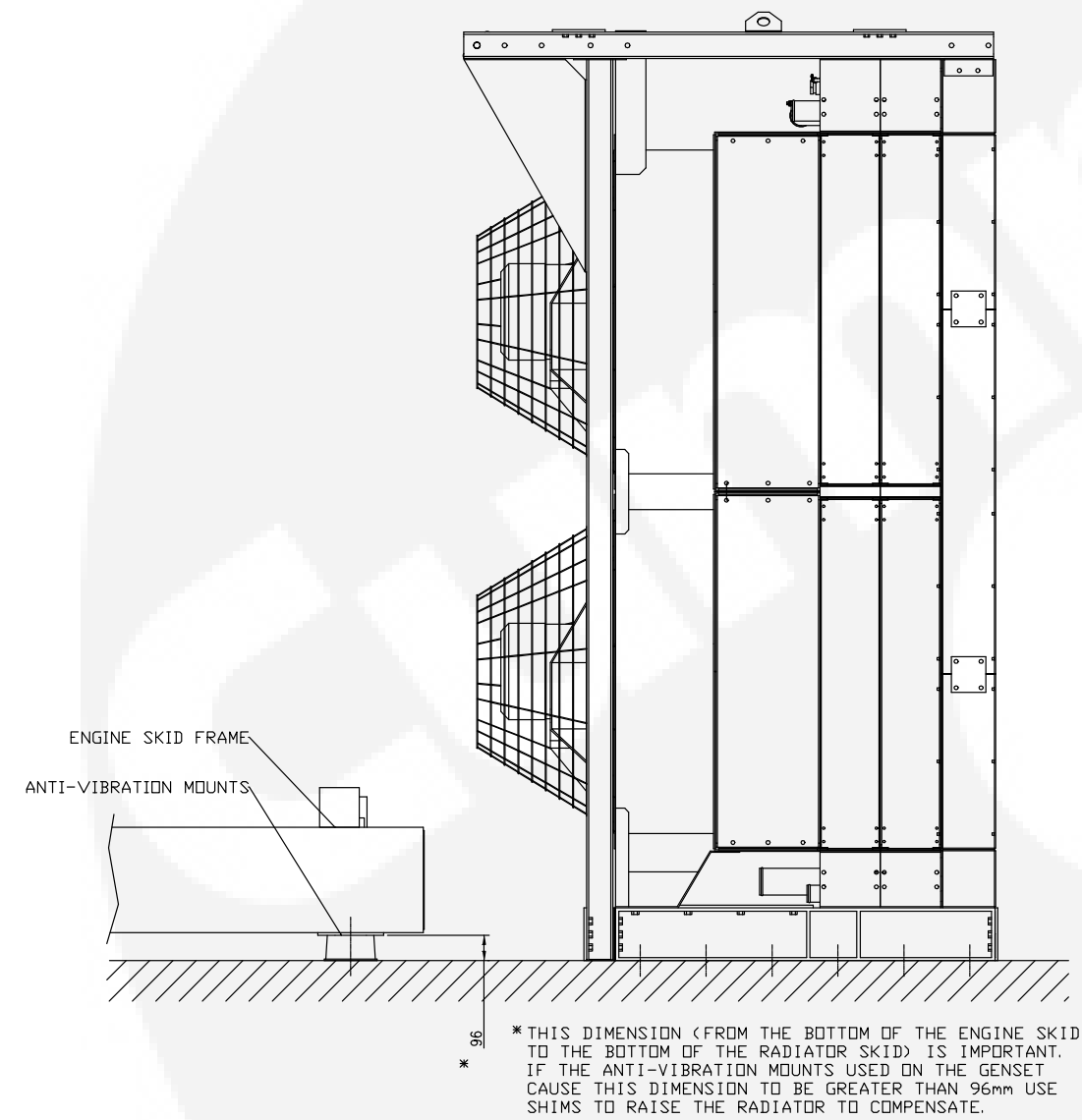
ONCE IN THE UPRIGHT POSITION UNITS CAN BE MOVED USING EITHER THE FORK LIFT CHANNELS IN THE BASE OR THE LIFTING BRACKETS SHOWN. EACH L/H AND R/H UNIT MUST BE LIFTED AND MOVED INDIVIDUALLY. UNDER NO CIRCUMSTANCES SHOULD ANY OF THE LIFTING POINTS BE USED TO LIFT BOTH THE L/H AND R/H UNITS AT THE SAME TIME.

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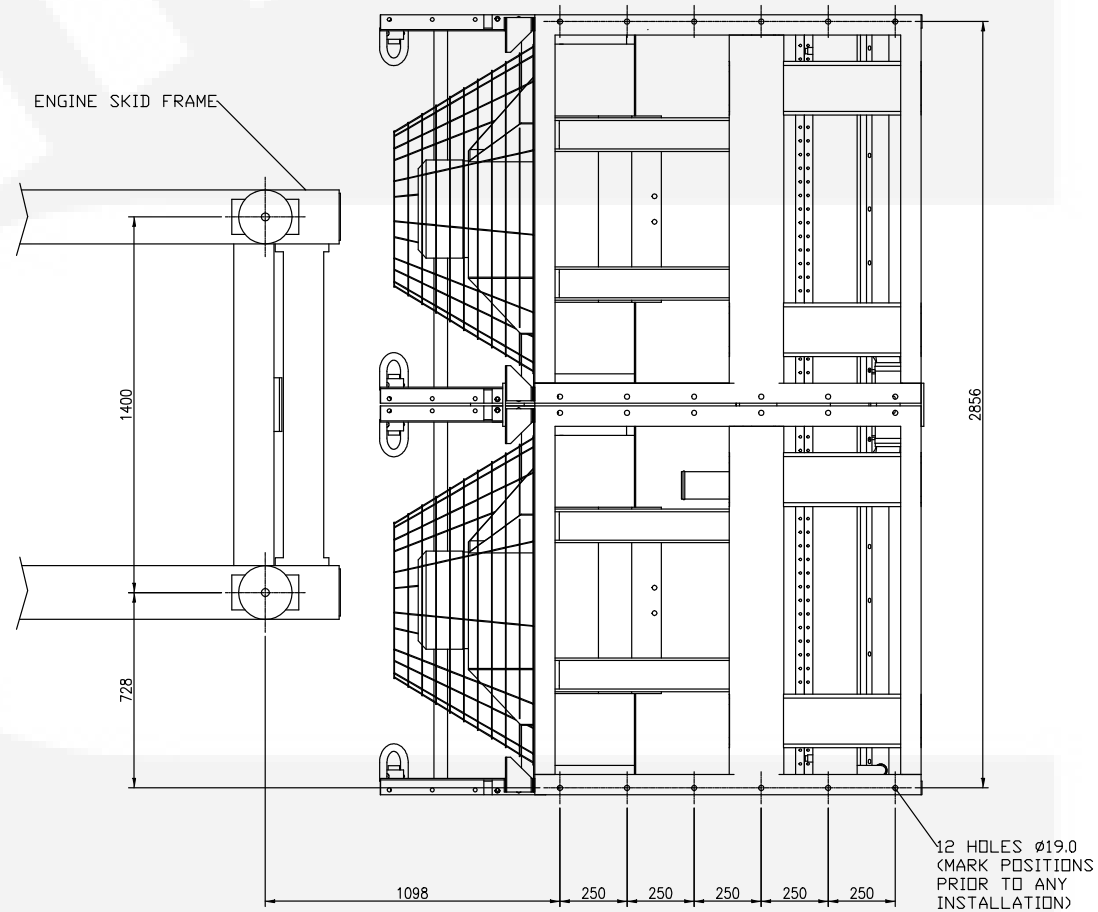
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

FIXING POSITIONS

NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATORS MUST BE FIXED IN THE CORRECT POSITION, BOTH IN RELATION TO EACH OTHER AND TO THE ENGINE.



R/H SIDE ELEVATION



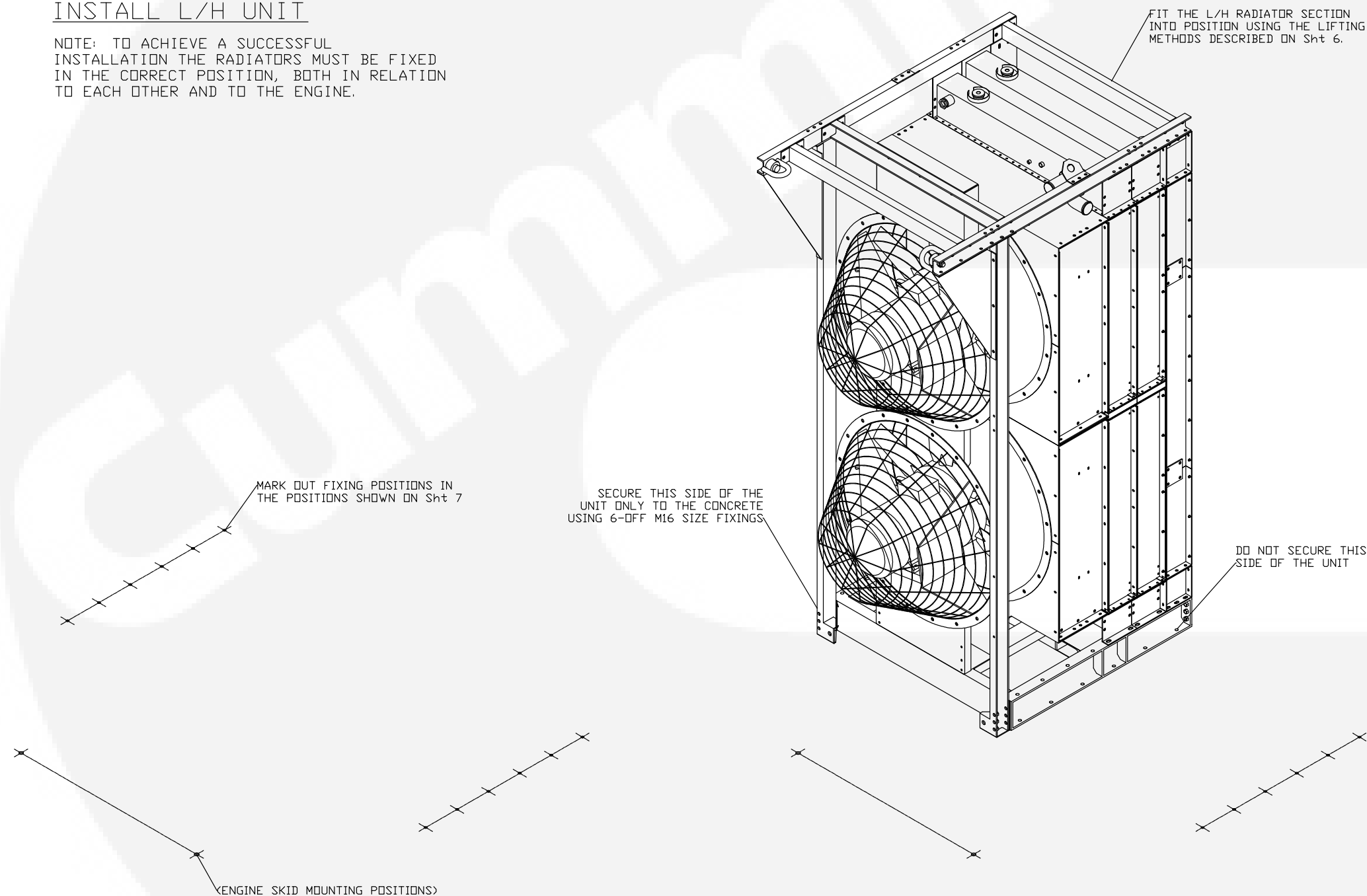
UNDERSIDE ELEVATION

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## INSTALL L/H UNIT

NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATORS MUST BE FIXED IN THE CORRECT POSITION, BOTH IN RELATION TO EACH OTHER AND TO THE ENGINE.



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## INSTALL L/H UNIT

NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATORS MUST BE FIXED IN THE CORRECT POSITION, BOTH IN RELATION TO EACH OTHER AND TO THE ENGINE.

NOTE:  
DO NOT LIFT THIS RADIATOR SECTION WITHOUT FIRST REFITTING THE REMOVEABLE FRAME PANELS

REMOVE THESE FRAME SECTIONS

LEAVE THE STONEGUARDS IN PLACE

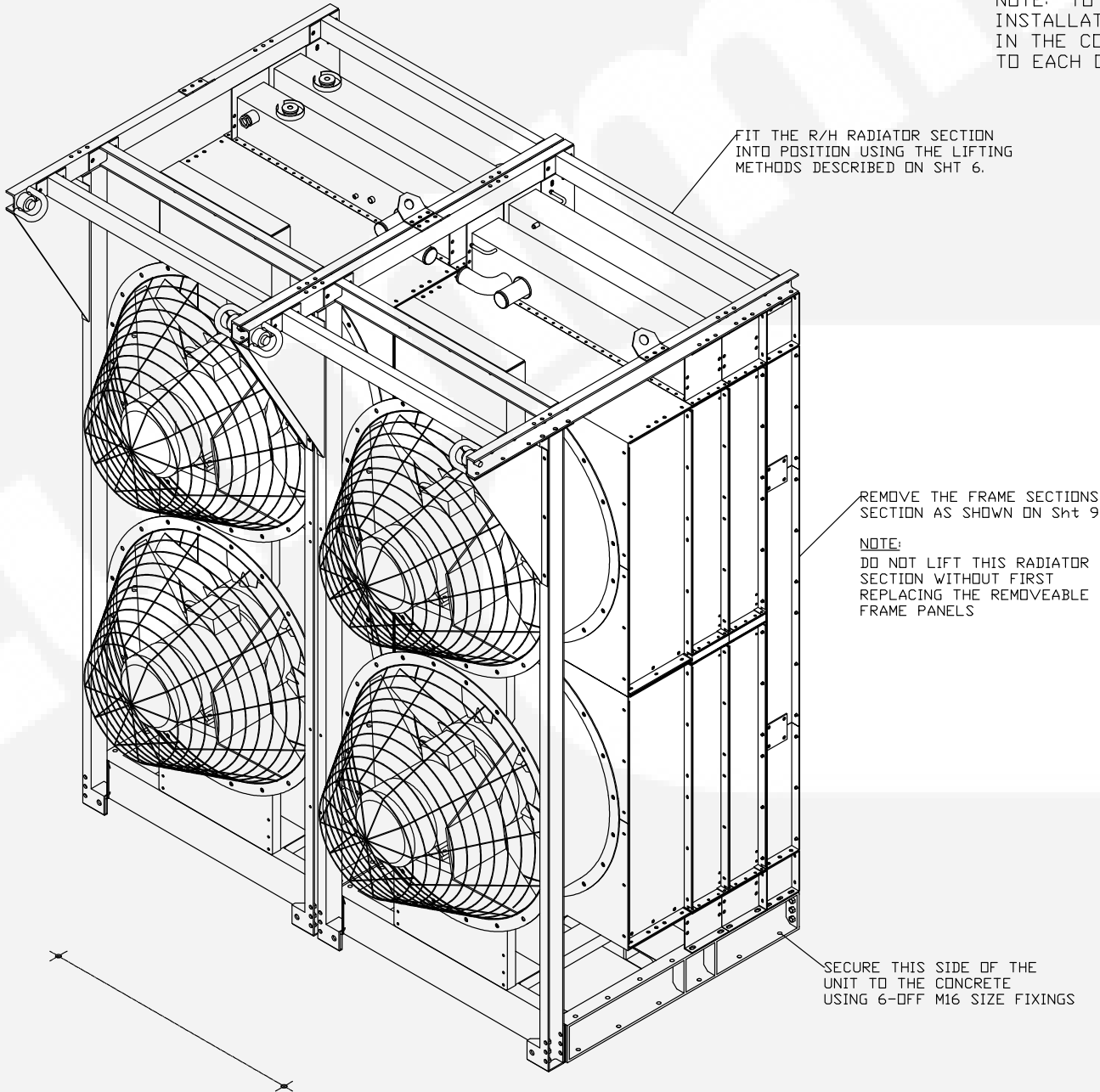
REMOVE ANY FEET BETWEEN THE PLENUM AND SKID (IF FITTED)

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THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

INSTALL R/H UNIT

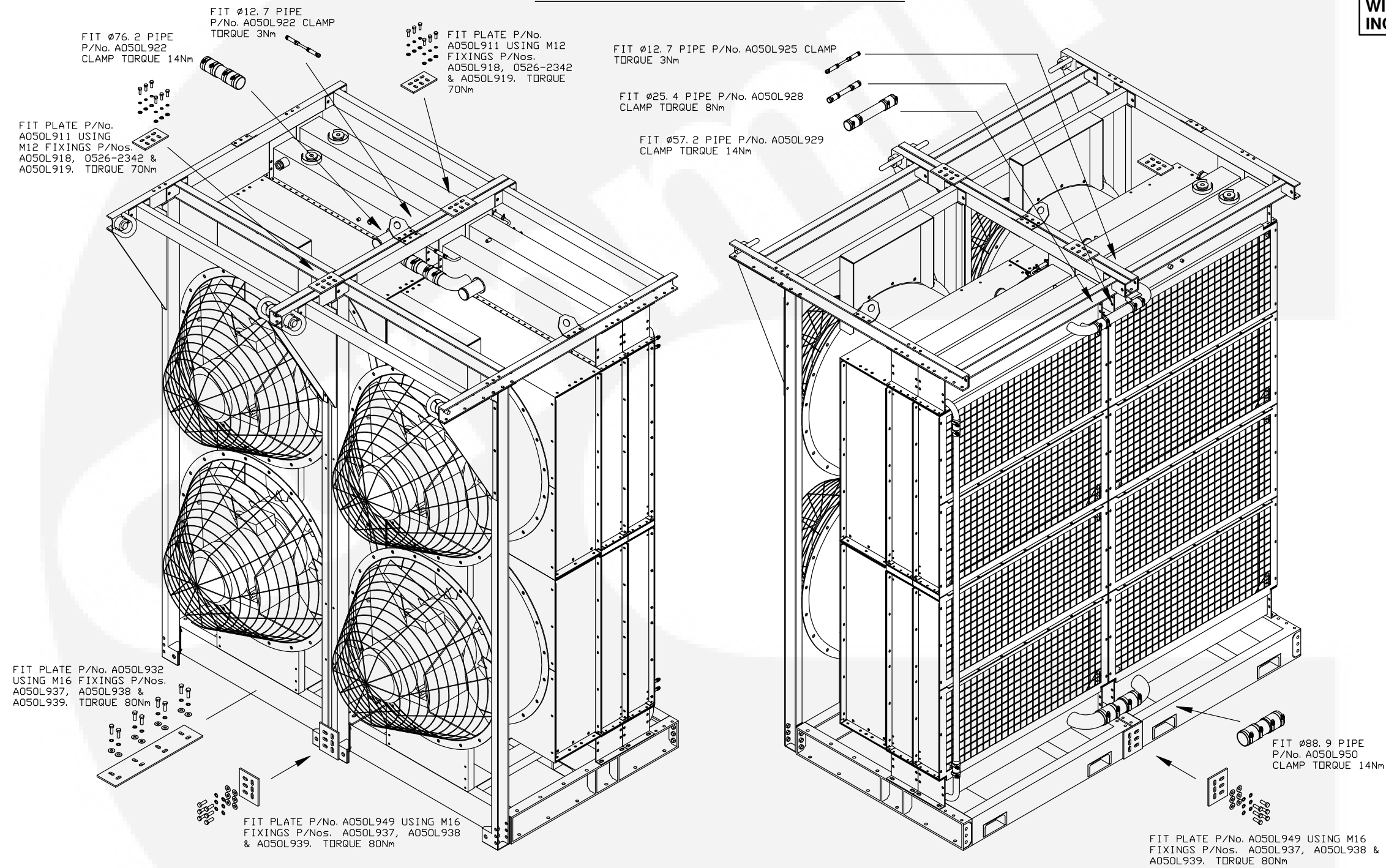
NOTE: TO ACHIEVE A SUCCESSFUL INSTALLATION THE RADIATORS MUST BE FIXED IN THE CORRECT POSITION, BOTH IN RELATION TO EACH OTHER AND TO THE ENGINE.



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FIT INTERCONNECTING PARTS

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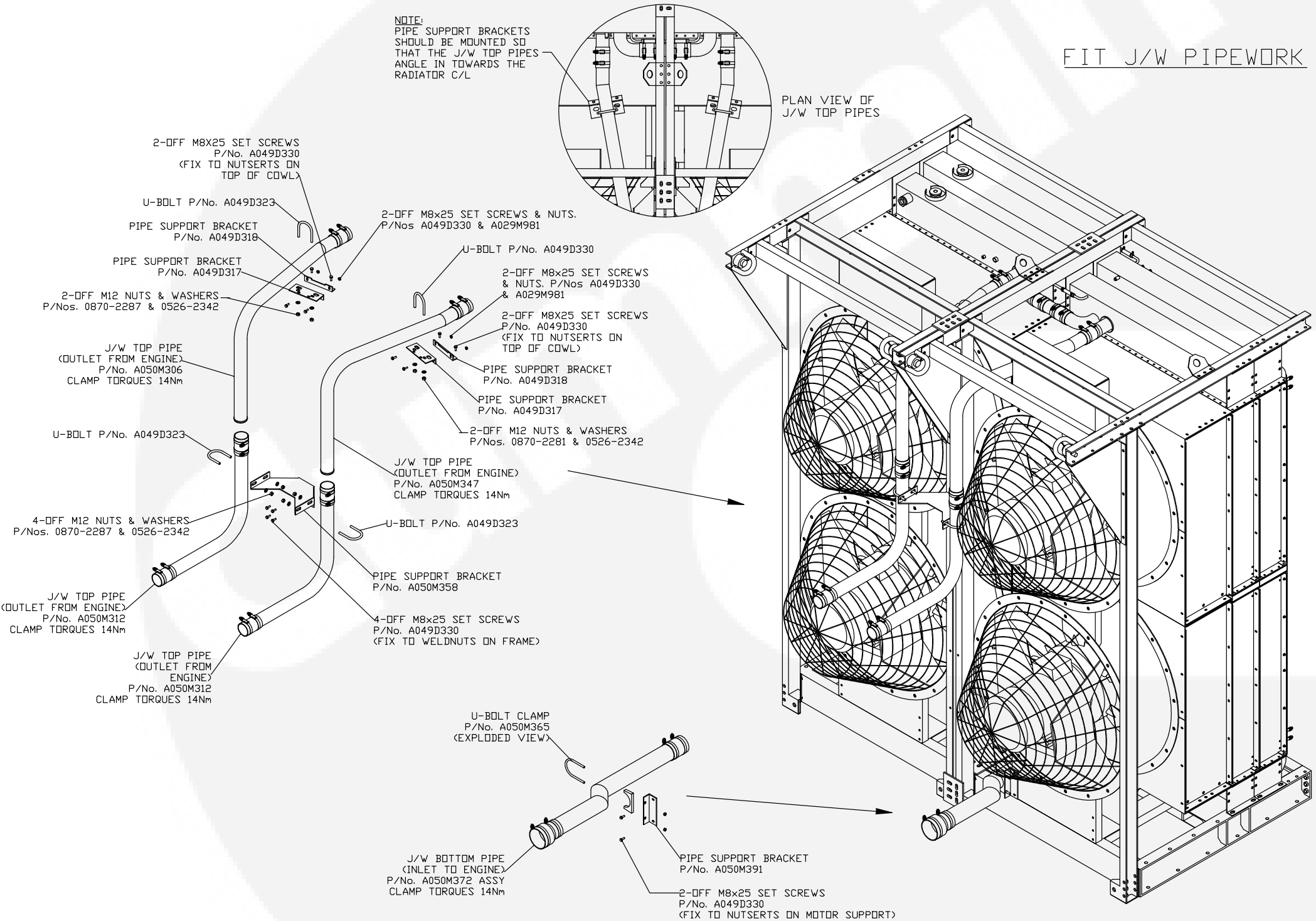


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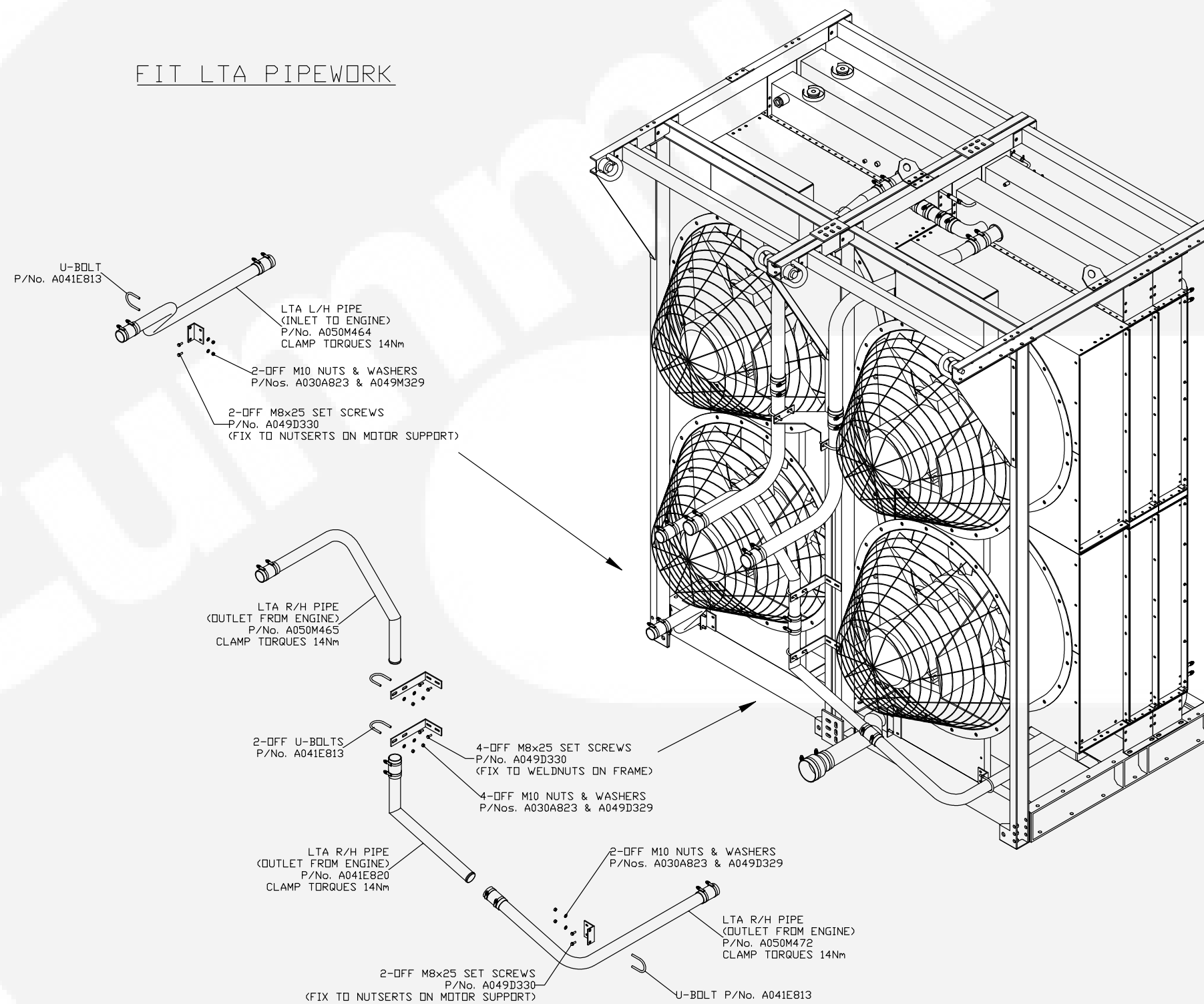
FIT J/W PIPEWORK



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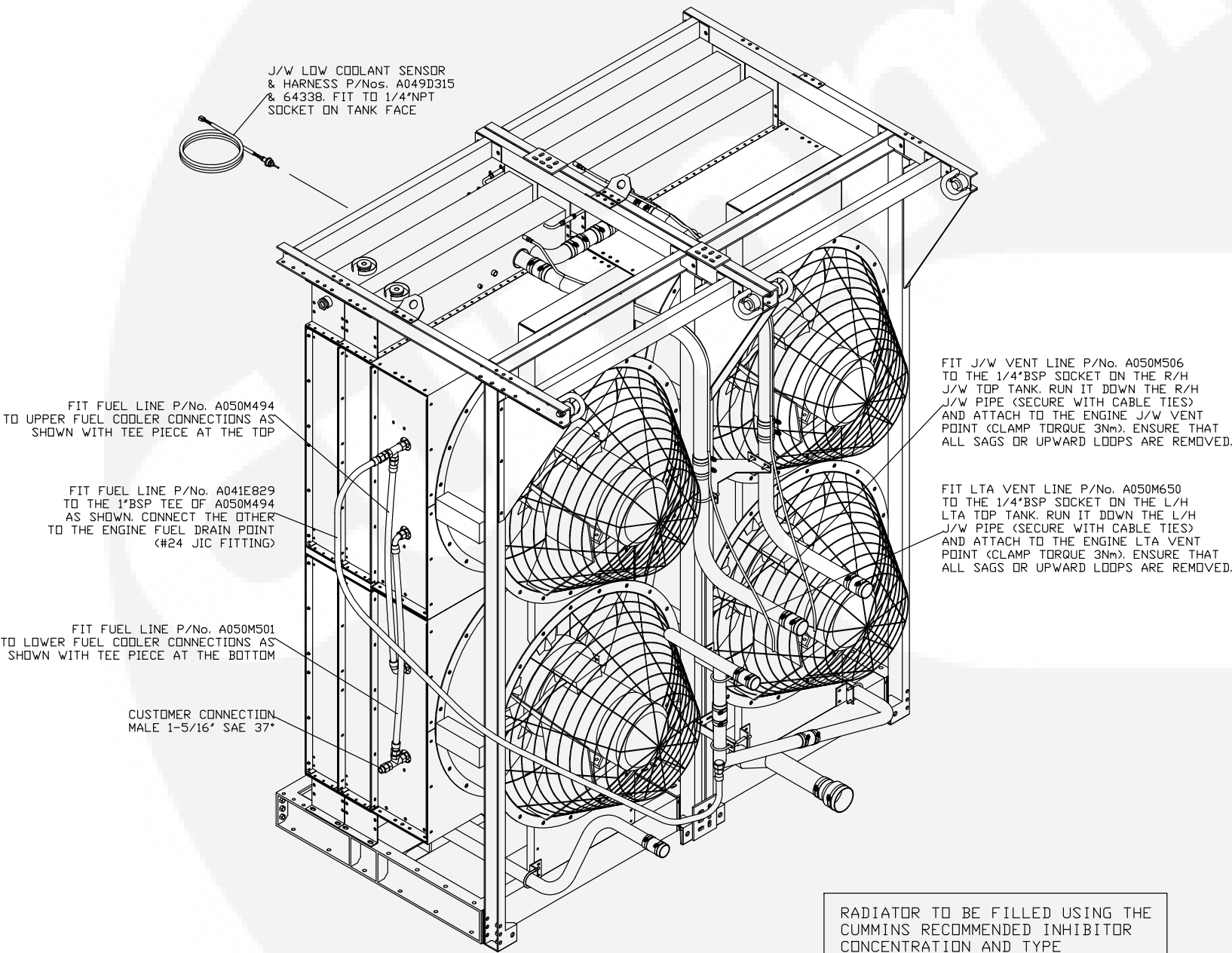
## FIT LTA PIPEWORK



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FIT FUEL, VENT LINES AND LEVEL SENSORS



RADIATOR DATA

J/W CIRCUIT COOLANT VOLUME: 281L  
(INCLUDES PIPEWORK)

LTA CIRCUIT COOLANT VOLUME: 206L  
(INCLUDES PIPEWORK)

MOTOR DETAILS (50Hz UNIT)

4-OFF, 180L FRAME SIZE, 22KW  
400V 3ph 50HZ  
INSULATION CLASS F

SEE THE PLATE ON THE MOTOR FOR BEARING  
REGREASE INTERVALS AND INFORMATION

MOTOR DETAILS (60Hz UNIT 460V)

4-OFF, 180L FRAME SIZE, 28KW  
460V 3ph 60HZ  
INSULATION CLASS F

SEE THE PLATE ON THE MOTOR FOR BEARING  
REGREASE INTERVALS AND INFORMATION

MOTOR DETAILS (60Hz UNIT 380V)

4-OFF, 180L FRAME SIZE, 28KW  
380V 3ph 60HZ  
INSULATION CLASS F

SEE THE PLATE ON THE MOTOR FOR BEARING  
REGREASE INTERVALS AND INFORMATION

MOTOR DETAILS (60Hz UNIT 460V UL)

4-OFF, 284T FRAME SIZE, 18.5KW  
460V 3ph 60HZ  
INSULATION CLASS F

SEE THE PLATE ON THE MOTOR FOR BEARING  
REGREASE INTERVALS AND INFORMATION

MOTOR DETAILS (60Hz UNIT 380V UL)

4-OFF, 284T FRAME SIZE, 18.5KW  
380V 3ph 60HZ  
INSULATION CLASS F

SEE THE PLATE ON THE MOTOR FOR BEARING  
REGREASE INTERVALS AND INFORMATION

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ITEM	QTY	PART NO.	DESCRIPTION
1	1		
2	1	0130-5997-01	RADIATOR (50C)
3	1	0130-5997-02	RADIATOR (50C)
4	1	0130-5997-03	RADIATOR (50C)
5	1	0130-5997-04	RADIATOR (50C)
6	1	0130-5997-05	RADIATOR (50C)
7	1	0319-5235-02	FRAME-CABINET
8	1	0300-5812	CONTROL ASSY (RADIATOR)
9	1	0338-4403-01	HARNESS-POWER
10	1	0338-4403-02	HARNESS-POWER
11	1	0338-4403-03	HARNESS-POWER
12	1	0338-4403-04	HARNESS-POWER
13	1	0338-4407	HARNESS-CONTROL
14	1	0501-0811	HOSE ASSY (1" BSPX1" BSP 90DEG FM/FM)
15	4	0505-2161-02	ADAPTER-PIPE (1" BSPTX1-1/2"NPT M/M)
16	4	0800-3017-20	SCREW-HEX HD M8 X 25 LONG
17	4	0862-0026-55	NUT-HEX (REG STL)
18	4	0526-0399-60	WASHER-FL
19	0.1	0850-0114-54	WASHER-LOCK SPRING M8 716370
20	4	0524-0826	SEALANT-THREAD
21	4	0098-8094	LABEL-WARNING (PRESS LIQUID)
22	5	0098-8095	LABEL-WARNING (HOT SURFACE)
23	1	0098-8104-01	LABEL-WARNING
24	1	0098-8104-04	LABEL-WARNING (VARIOUS VOLTAGES)
25	2	0098-8104-05	LABEL-WARNING
26	1	0098-8106	LABEL-INFORMATION (TAG-WATER FILL)
		0098-8130	LABEL-CAUTION (ROTATING PARTS)

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ITEM	QTY	PART NO.	DESCRIPTION
27	1	0338-3832	HARNESS-LCL

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