# DIESEL GENERATOR INSTALLATION AND OPERATION MANUAL

UL FILE NUMBER: AU5210

## Dear Aksa Generating Set Users:

First of all, we would like to thank you for your choice of an Aksa Generating Set.

It is solid, safe and reliable machine, built according to the latest technology and standards.

This operating and maintenance manual is designed and developed to make you familiar with the generating system.

Please read the following instructions carefully before starting to use your machine.

This manual gives general information about mounting, operation and maintenance of the generating set. Tables and diagrams are also available outlining your generating set.

Never operate, maintain or repair your generating set without taking general safety precautions.

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

Aksa Power Generation USA does not assume responsibility for possible errors.
Aksa Power Generation USA reserves to make changes without prior notice.

# DIRECTORY

# 1. INTRODUCTION

**SAVE THESE INSTRUCTIONS**
**THESE INSTRUCTIONS ARE IMPORTANT**

This operations and maintenance manual has been prepared to assist the operator with the proper operation and maintenance of the generating set. Observing the suggestions and rules in this manual will ensure that the generating set operates at maximum performance and efficiency throughout the life of the unit.
Required maintenance should be performed more frequent in dirty and dusty environments in order to keep the generating set in good working condition.

Each generating set indicates the model and serial numbers on the base frame. Also, each set has a data plate (See Below) indicating the manufacture date, voltage, current, power in kVA, frequency, power factor, and weight of the generating set. This information will be necessary for spare part orders, warranty validity, and service calls.

| AKSA Power Generation USA | | | | 371 Exchange Street, West Monroe, LA 71292 | | |
|---|---|---|---|---|---|---|
| | | | | Tel: 318 855 8377 | Fax: 318 855 8381 | |
| | | | | sales@aksausa.com | www.aksausa.com | |
| Model | | | | Product Date | | |
| Prime Power | | | | Standby Power | | |
| Prime A | | | | Standby A | | |
| Alternator Model | | | | Serial Number | | |
| Dimensions | | | | Alternator Serial No. | | |
| Weight | | | | Engine Family Name | | |
| Volts | | | | List Number | | |
| Phase Connection | | | | | | |
| Rated Ambient Temperature | | | | File Number | AU5210 | |
| Insulation System Class | | | | Control Number | 4SV1 | |
| Hz | | pf | | Unbalanced Capability | 25% | |
| Phase | | r.p.m. | | AKSA 1 | ✓ | |

**Figure 1.1**

The generating set is designed to be safe when used properly. However, responsibility for safety rests with the personnel who install, use, and maintain the set. If the following safety precautions are followed, the possibility of an accident is minimized. Before performing any procedure or operating technique, it is up to the user to ensure that it is safe. The generating set should only be operated by personnel who are authorized and trained.
Only people that have been properly trained should be allowed to operate, adjust, perform maintenance, or make repairs on Aksa Power Generation equipment. It is the responsibility of the purchaser to appoint operators with the appropriate training and skill for each job category.

**Skill level 1: Operator**

An operator that is trained in all aspects of operating the unit with the push buttons and is also trained to know the safety aspects.

**Skill level 2: Mechanical technician**

A mechanical technician is trained to operate the unit with the same proficiency as the operator. The mechanical technician is also trained to perform maintenance and repair as described in the operation manual. A mechanical technician is allowed to change the settings of the controls and safety system. A mechanical technician does not work on live electrical components.

**Skill level 3: Electrical technician**

An electrical technician and has the same qualifications as both the operator and the mechanical technician. The electrical technician may also carry out electrical repairs within the various enclosures of the unit. This includes work on live electrical components.

**Skill level 4: Specialist from the manufacturer**

This is a skilled specialist sent by the manufacturer or its agent to perform complex repairs or modifications to the equipment. It is recommended that not more than two people operate the unit; more operators could lead to unsafe operating conditions. Take necessary steps to keep all unauthorized personnel away from the unit to eliminate all possible source of danger at the unit.

The manufacturer does not accept any liability for damages caused by the use of non-original parts, Modifications, additions, or conversions made without the manufacturer's approval in writing.

The stationary engine generator assembly is to be installed over noncombustible materials and shall be located in such a manner that shall prevent combustible materials from accumulating under the generator set.

# 2. GENERAL SAFETY PRECAUTIONS INSTRUCTIONS

### 2.1. General

1. The owner is responsible for maintaining the unit in a safe operating condition. Unit parts and accessories must be replaced if missing or unsuitable for safe operation.
2. Only operate this unit for its intended purpose and within its rated limits (pressure, temperature, speeds, etc.).
3. Gen-set and equipment shall be kept clean, i.e. as free as possible from oil, dust or other deposits.
4. To prevent an increase in operating temperature, inspect and clean heat transfer surfaces (cooler fins, intercoolers, water jackets, etc.) regularly.
5. Handle all substances with care. Keep spill containment supplies nearby in case of spills in order to prevent environmental hazards. Fuel and oil are flammable and should be kept away from any sources of ignition; the proper fire extinguisher should be kept nearby in case of fire.

**WARNING**

! Read and understand all safety precautions and warnings before operating or performing maintenance on the generating set.

! Failure to follow the instructions, procedures, and safety precautions in this manual may increase the possibility of accidents and injuries.

! Do not attempt to operate the generating set if any unsafe condition is known.

! If the generating set is unsafe, put danger notices and disconnect the battery negative (-) lead so that it cannot be started until the condition is corrected.

! Disconnect the battery negative (-) lead prior to attempting any repairs or cleaning inside the enclosure.

! Install and operate this generating set only in full compliance with relevant National, Local or Federal Codes, Standards or other requirements.

### 2.2. Installation, Handling, and Towing

Chapter 4 and 12 of this manual cover the procedures for installation, handling and towing of generating sets. These chapters should be read before installing, moving and/or lifting the generating set or towing a mobile set. The following safety precautions should be noted:

**WARNING**

! Make electrical connections in compliance with relevant Electrical Codes, Standards or other requirements. This includes requirements for grounding and ground/earth faults.

! For stationary generating sets with remote fuel storage systems, make sure such systems are installed in compliance with relevant Codes, Standards or other requirements.

! Engine exhaust emissions are hazardous to personnel. The engine exhaust for all indoor generating sets must be piped

outdoors via leak-free piping in compliance with relevant Codes, Standards and other requirements. Ensure that hot exhaust silencers and piping are clear of combustible material and are guarded for personnel protection per safety requirements. Ensure that fumes from the exhaust outlet will not be a hazard.

! Never lift the generating set by attaching to the engine or alternator lifting lugs, instead use the lifting points on the base frame or canopy.

! Ensure that the lifting rigging and supporting structure is in good condition and has a capacity suitable for the load.

! Keep all personnel away from the generating set when it is suspended.

### 2.3. Fire and Explosion

Fuel and fumes associated with generating sets can be flammable and potentially explosive. Proper care in handling these materials can dramatically limit the risk of fire or explosion. However, safety dictates that fully charged BC and ABC fire extinguishers are kept on hand. Personnel must know the specific uses for each one and how to operate them.

**WARNING**

! Ensure that the generating set room is properly ventilated.

! Keep the room, the floor and the generating set clean. When spills of fuel, oil, battery electrolyte or coolant occur, they should be cleaned up immediately.

! Never store flammable liquids near the engine.

! Do not smoke or allow sparks, flames, or other sources of ignition around fuel or batteries.

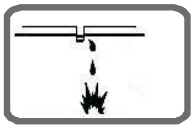
! Fuel vapors are explosive. Hydrogen gas generated by charging batteries is also explosive.

! Never store flammable liquids near the engine.

! Do not smoke or allow sparks, flames, or other sources of ignition around fuel or batteries. Fuel vapors are explosive. Hydrogen gas generated by charging batteries is also explosive.

! Turn off or disconnect the power to the battery charger before making or breaking connections with the battery.

! To avoiding arcing keep grounded conductive objects (such as tools) away from exposed live electrical parts (such as terminals). Sparks and arcing might ignite fuel or vapors.



! Avoid refilling the fuel tank while the engine is running.

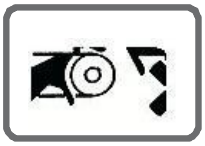
! Do not attempt to operate the generating set with any known leaks in the fuel system.

**2.4. Mechanical**

The generating set is designed with guards for protection from moving parts. Care must still be taken to protect personnel and equipment from other mechanical hazards when working around the generating set.

**WARNING**

! Do not attempt to operate the generating set with the safety guards removed. While the generating set is running do not attempt to reach under or around the guards to do maintenance or for any other reason.



! Keep hands, arms, long hair, loose clothing and jewelers away from pulleys, belts and other moving parts.

**Attention: Some moving parts cannot be seen clearly when the set is running.**

! Keep access doors on enclosures closed and locked when not required to be open if equipped.

! Avoid contact with hot oil, hot coolant, hot exhaust gases, hot surfaces, sharp edges, and sharp corners.

! Wear protective clothing including gloves and hat when working around the generating set.

! Do not remove the radiator filler cap until the coolant has cooled. After cooling has taken place, loosen the cap slowly to relieve any excess pressure before removing the cap completely.

**2.5. Chemical**

Fuels, oils, coolants, lubricants, and the battery electrolyte used in this generating set are typical of the industry. However, they can be hazardous to personnel if not treated properly.

**WARNING**

! Do not swallow or allow skin contact with fuel, oil, coolant, lubricants, or the battery electrolyte. If swallowed, seek medical treatment immediately. Do not induce vomiting if fuel is swallowed. For skin contact, wash with soap and water.

! Do not wear clothing that has been contaminated by fuel or lube oil.

! Wear an acid resistant apron and face shield or goggles when servicing the battery.

! If any electrolyte gets on skin or clothing flush immediately with large quantities of water.

**2.6. Noise**

Generating sets that are not equipped with sound attenuating enclosures can produce noise Levels in excess of 105 dB(A). Prolonged exposure to noise levels above 85 dB(A) is hazardous to hearing.

**WARNING**

Ear protection must be worn at all times when operating or working around an operating generating set.

**2.7. Electrical**

Safe and efficient operation of electrical equipment can be achieved only if the equipment is correctly installed, operated, and maintained.

**WARNING**

! The generating set must be connected to the load only by trained and qualified electricians who are authorized to do so. Connections must be made in compliance with relevant Electrical Codes, Standards and other regulations.

! Ensure that the generating set is effectively grounded in accordance to all relevant regulations prior to operation.

! The generating set should be shut down with the battery negative (-) terminal disconnected prior to attempting to connect or disconnect load connections.

! Do not touch electrically energized parts of the generating set and/or interconnecting cables or conductors with any part of the body or with any non-insulated conductive object.

! Replace the generating set terminal box cover as soon as connection or disconnection of the load cables is complete. Do not operate the generating set without the cover securely in place.

! Connect the generating set only to loads and/ or electrical systems that are compatible with its electrical characteristics and that are within its rated capacity.

! Keep all electrical equipment clean and dry. Replace any wiring where the insulation is cracked, cut, abraded or damaged in any other way. Replace terminals that are worn, discolored or corroded. Keep terminals clean and tight.

! Insulate all connections and disconnected wires.

! Use only Class BC or Class ABC extinguishers on electrical fires.

! Caution: risk of electric shock, the grounded conductor must be bonded to ground in accordance with the National Electric Code NFPA 70.this unit shall not be used in floating output applications.

! Notice: isolated neutral not bonded to frame.


warning:
High voltage

**2.8 First Aid for Electric Shock**

! Do not touch the victim's skin with bare hands until the source of electricity has been turned off.

! If possible, switch the power off. Otherwise, pull the plug or cable away from the victim by its insulation or by using some other insulted device.

! If this is not possible, stand on any dry insulating material such as dry wood and pull the victim clear of the conductor.

! If the victim is breathing, turn the victim clear of the conductor, preferably using insulated material such as dry wood.

! If victim is breathing, turn the victim into the recovery position described below. If victim is unconscious, perform resuscitation as required:

**Open the airway**

Tilt the victim's head back and lift the chin upwards.

Remove objects from the mouth or throat (including false teeth, tobacco or chewing gum).

**Breathing**

Check that the victim is breathing by looking, listening and feeling for the breath.

**Circulation**

Check for pulse in the victim's neck.

**If victim is not breathing, but pulse is present:**

● Pinch the victim's nose firmly.

● Take a deep breath and seal your lips around the victim's lips.

● Blow slowly into the mouth watching for the chest to rise.

● Let the chest fall completely. Give breaths at a rate of 10 per minute.

● If the victim must be left to get help, give 10 breaths first and then return quickly and continue.

● Check for pulse after every 10 breaths. When breathing restarts, place the victim into the recovery position described later in this section.

**If victim is not breathing and no pulse can be found:**

● Call or telephone for medical help.

● Give two breaths and start chest compression as follows:

● Place heel of hand/2 fingers. Place above ribcage/breastbone junction.

● Place other hand on top and interlock fingers.

● Keeping arms straight, press down 4-5 cm at a rate of 15 times per minute.

● Repeat cycle (2 breaths and 15 compressions) until medical helps takes over.

●If condition improves, confirm pulse and continue with breaths.

●Check for pulse after every 10 breaths.

●When breathing restarts, place the victim into the recovery position described below.

**2.9. Recovery Position**

●Turn the victim onto the side.

●Keep the head tilted with the jaw forward to maintain the open airway.

●Make sure the victim cannot roll forwards or backwards.

●Check for breathing and pulse regularly. If either stops, proceed as above.

**WARNING**

! Do not give liquids until victim is conscious.

# 3. GENERAL DECRIPTION

### 3.1. rating Set Description and Identification

Diesel-electric generating sets are independent units for the production of electric power comprised of a constant voltage synchronous generator driven by an internal-combustion, diesel-cycle engine.

The sets are used for two main purposes:

**A-Continuous duty sets,**

These are used to produce electric power for countless requirements (lighting, heating, etc.) in areas where other sources or power are unavailable.

**B- Emergency duty sets,**

These are used in such instances where public utility failures are liable to cause damage to lives, to materials, to finances, (i.e. hospitals, industrial plants with non-stop operating cycles, etc.)or to meet peak energy demands.

According to their application, the sets are further divided into:

- set for use on land
- set for use at sea

The sets for use on land can be either:

- stationary sets (fixed installation), or
- mobile sets (mobile installation)

These two types of sets are available in a vast range of versions for every operating requirement with the main ones being:

- hand control generating sets
- stand-by generating sets

The standard stationary generating set comprises:

- diesel engine
- synchronous generator
- coupling
- metal sub-base with vibration isolators
- starter batteries
- fuel tank within the bed-plate
- instrument panel
- exhaust gas silencer.

The normal temperature range for the operation of this genset is 5° F—104° F. If the temperature drops below 23° F, a heater may be required to aid start.

This Aksa Generating Set has been designed as a complete package to provide superior performance and reliability. Figure 3.1 shows a typical generating set with major components labeled. However, each set will be slightly different due to the size and configuration of the major components. This section briefly describes the parts of the generating set. Further information is provided in later sections of this manual.

Each generating set is provided with a Rating Label (Item 1) generally fixed to the base frame. This label contains the information needed to identify the generating set and its operating characteristics. This information includes the model number, serial number, output characteristics such as voltage and frequency, output rating in kVA and kW, product date and weight.

The model and serial numbers uniquely identify the generating set and are needed when ordering spare parts or obtaining service or warranty work for the set. AC series generating sets are an Alternating Current generators, built for continuous operating at sites where no electricity is available (some models are excepted) or as stand-by in case of interruption of the main utility power.

The generator operates at 208/120 V in line-to-neutral mode and 277/480 V in line-to-line mode. The AC series generating set is driven by a water-cooled diesel engine.

NOMENCLATURE
BREAKDOWN:
EXAMPLE (Three phase Gen-set) 8-10 symbol model designation APD-ULP611
1st -3rd –model series
4th -5th symbols "UL"
6th - (optional) Engine Type
P-Perkins
J- John deer
M- Mitsubishi
7th -10th –KW ratings
(9,13,20,28,30,40,55,65,80,82,100,125,150,178,180,200,250,275,300,350,400,461,500,512,585,511,800,1000,1250,1600,2000)

EXAMPLE (single phase Gen-set) 8-10 symbol model designation APD-ULP100
1st -3rd –model series
4th -5th symbols "UL"
6th - (optional) Engine Type
P-Perkins
7th -9th –KW ratings
(10,13,20,28,30,58,65,82,100,150)
10th -phase

### 3.2. Generating Set Main Parts

Figure 3.1 Typical generating set configuration

| No | Description |
|---|---|
| 1 | Aksa generating set rating label |
| 2 | Diesel engine |
| 3 | Air filter |
| 4 | Battery |
| 5 | Battery charging alternator |
| 6 | Radiator |
| 7 | Alternator |
| 8 | Terminal box |
| 9 | Base frame |
| 10 | Fuel tank (inside the base frame) |
| 11 | Vibration isolators |
| 12 | Control Panel |

Table 3.1

### 3.3. Diesel Engine

The diesel engine powering the generating set (Item 2) has been chosen for its reliability and the fact that it has been specifically designed for powering generating sets.

It has a heavy duty, industrial engine with a four-stroke compression ignition system.

It has been fitted with all accessories necessary to provide a reliable power supply. These accessories include, among others, a cartridge type dry-air filter (item 3) and either a mechanical or an electronic engine speed governor. The engine cylinder block is one piece cast iron, vertical cylinders with inline overhead valves, and camshaft in block or V- type, according to the type.

The thermally loaded flame plate is efficiently water cooled. The crankshaft is forged in one piece of high tensile steel.

Lubrication: forced lubrication via gear pump, special paper cartridge -type filters, lubricant cooling via heat exchanger on most versions.

### 3.4. Engine Electrical System

The engine electrical system is 12 volt or 24 volts DC, negative ground/earth. This system includes an electric engine starter, a battery (item 4) and a battery charging alternator (item 5). For 12 volts electrical system one battery is given. For 24-volt system two lead-acid batteries are given. Other types of batteries may be fitted if they were specified.

### 3.5. Cooling System

The engine cooling system is water cooled. The water cooled system is comprised of a radiator (item 6) a pusher fan and thermostat. The alternator has its own internal fan to cool its components.

### 3.6. Synchronous Alternator

This is a horizontal axle alternator (synchronous three phase), on rolling bearings, It is self-ventilated within the room with low-loss silicon-sheet stator bundle, and an electrolytic copper winding with class H insulation.
The output electrical power is normally produced by a screen protected, drip-proof, self-exciting, self-regulating, brushless alternator. (Item 7) Which is fine tuned to the output of this generating set. Mounted on top of the alternator is a sheet steel terminal box (item 8). Normally, the voltage imbalance capability is 1%, but if generator operation needs to be synchronous, this data should be reduced to 0.5%.

### 3.7. Coupling

Engine and alternator are firmly joined by a coupling cone that guarantees the proper assembly. If Mono-support machines are used, a special flexible disk is used in place of a flexible coupling.

### 3.8. Fuel Tank and Base Frame

The engine and alternator are coupled together and mounted on a heavy duty steel base-frame (Item 9). This base frame includes a fuel tank (Item 10) with capacity of approximately 8 hours operation under variable loads. The tank is complete with filling cap and fuel level gauge, and tit is connected, by flexible joints, to the intake piping and to the overflow piping containing fuel from the injector drain. High power gen-set's fuel tank is separate from gen-set. State: If the base frame have an open bottom, the stationary engine generator assembly shall be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

### 3.9. Vibration Isolation

The generating set is fitted with vibration isolators (Item 11) which are designed to reduce engine vibration being transmitted to the foundation on which the generating set is mounted. These isolators are fitted between the engine /alternator feet and the base frame.

### 3.10. Silencer and Exhaust system

Exhaust gases from the turbocharger are discharged toward atmosphere through a silencer. These should be vented as high as possible to prevent them from re-entering the engine via the charge air intake and polluting the radiator fins.
It is important to note that the turbocharger nozzles must always be free of loads. A stainless steel exhaust compensator is

delivered with generator set. Exhaust lines of different engines shall not be mixed in a common stack, but should be routed separately in individual ducts and be enclosed within a chimney.

Suitable material is carbon steel sheet, and recommended calculation temperature is 977°F. A permanent means of drainage for rain and condensate shall be provided to prevent water from entering the silencer or the engine. An exhaust silencer is provided, shipped loosely, for installation with the generating set. The silencer and exhaust system significantly reduces the amount of noise emitted by the engine and directs exhaust gases through safe outlets.

The exhaust silencer is made of a carbon steel receiver and contains a sound attenuator and wave de-phasing system made of perforated steel sheet and heavy rock wool. It is asbestos-free. The exhaust silencer is delivered in two configurations with one being industrial attenuation and the other being critical attenuation.

### 3.11. Control System

One of several types of control systems and panels (item 12) may be fitted to control the operation and output of the set and also protect the set from possible malfunctions. Section 15 of this manual provides detailed information on these systems and will aid in the identification of the control system fitted on the generating set.

### 3.12 Field Wiring

It is the customer's responsibility to provide cables with terminals to connect the genset and the loads. Terminal uses standard JG copper connections, and the terminal size is chosen according to cable size (Terminals are listed in Table 10.2 below).When connecting the load cables, a torque wrench should be used to tighten the Grade 5 bolts for each phase. Torque requirements can be found in Table3.2. In most situations, the bus bar panel(breaker)will be mounted to the base frame. There is an access hole which can be utilized for making connections. See picture below.

1 Load cables connecting terminal of gen-set;

2 Load cables can be connected with gen-set through these Knock down holes;

3 Grounding terminal (UL listed KDER, installation tool:1/14'' hex wrench)

Figure 3.2 Gen-set field wiring of load cables

The customer should also connect the ground as shown in Figure 3.3 below using a UL Listed (KDER) terminal.

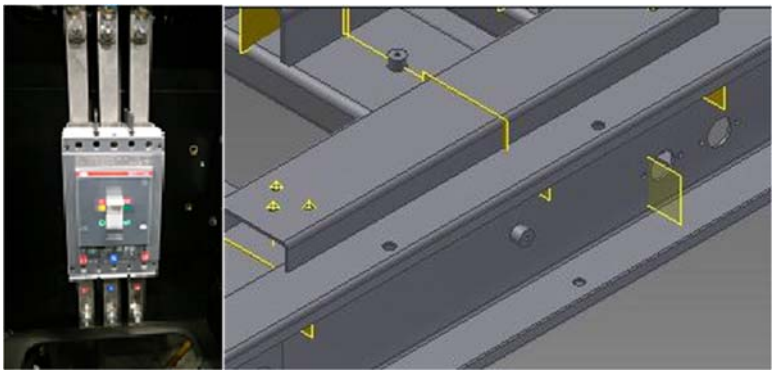


Figure 3.3 Grounding terminal

| BOLT SIZE | TIGHTENING TORQUE | | |
|---|---|---|---|
| | 8.8 rank | 10.9 rank | 12.9 rank |
| M10 | 36.1 ft·lb | 53.1 ft·lb | 62.0 ft·lb |
| M12 | 63.4 ft·lb | 92.9 ft·lb | 106.9 ft·lb |

Table 3.2

See attached Table 310.16 below in the NEC to properly size field conductors.The proper UL listed terminals for all terminations should be selected by determining suitability for the required application.

| NEC 2011 Table 310.15(B)(16) Allowable Ampacities of insulated Conductors Rated Up to and Including 2000 Volts,60 Through 90℃(140 Through 194℉),Not More Than The Conductors in Raceway, Cable or Earth(Directly Buried),Based on Ambient Temperature of 30℃(86℉) | | | |
|---|---|---|---|
| **Size AWG or kcmil** | **Temperature Rating of Conductor［See NEC Table 310.104(A)］** | | |
| | **60℃(140℉)** | **75℃(167℉)** | **90℃(194℉)** |
| | **Type TW,UF** | **Types:RHW THHW THW THWN XWWH** | **Types:TBS,SA,SIS,FEP FEPB MI,RHH,RHW-2,THHN THHW,THW-2,THWN-2,USE-2,XHH,XHHW,XHHW-2,ZW-2** |
| **COPPER** | | | |
| 18 | …. | …. | 14 |
| 16 | …. | …. | 20 |
| 14** | 15 | 20 | 28 |
| 12** | 20 | 25 | 38 |
| 10** | 30 | 35 | 47 |
| 8 | 40 | 50 | 60 |
| 6 | 55 | 65 | 80 |
| 4 | 70 | 85 | 100 |
| 3 | 85 | 100 | 125 |
| 2 | 95 | 115 | 140 |
| 1 | 110 | 130 | 165 |
| 1/0 | 125 | 150 | 180 |
| 2/0 | 145 | 175 | 230 |
| 3/0 | 165 | 200 | 280 |
| 4/0 | 195 | 230 | 325 |
| 250 | 215 | 255 | 375 |
| 300 | 240 | 285 | 430 |
| 350 | 260 | 310 | 450 |
| 400 | 280 | 335 | 495 |
| 500 | 320 | 380 | 530 |
| 600 | 350 | 420 | 610 |
| 700 | 385 | 460 | 630 |
| 750 | 400 | 475 | 650 |
| 800 | 410 | 490 | 675 |
| 900 | 435 | 520 | 700 |
| 1000 | 455 | 545 | 725 |
| 1250 | 495 | 590 | 750 |
| 1500 | 525 | 625 | 775 |
| 1750 | 545 | 650 | 790 |
| 2000 | 555 | 665 | 800 |

** Refer to NEC 310.15(B)(2) for the ampacity correction factors whree the ambient temperature is other than 30℃(86℉)

**Refer to NEC 240.4(D) for conductor overcurrent protection limitations.

**NEC Table 310.15(B)(16):Allowed Ampactities of insulated Conductors**

| | STANDBY (kW) | PRIME(kW) | STANDBY RATING AMPS | | | PRIME RATING AMPS | | | Phase Configuration |
|---|---|---|---|---|---|---|---|---|---|
| | | | 120/208 3p | 277/480 3p | 120/240 3p | 120/208 3p | 277/480 3p | 120/240 3p | |
| **APD-ULP9** | 9 | 8 | 31.2 | 13.5 | 27.1 | 27.8 | 12 | 24.1 | Three phase,Wye,Yn,Δ |
| **APD-ULP13** | 13 | 12 | 45.1 | 19.5 | 39.1 | 41.6 | 18 | 36.1 | Three phase,Wye,Yn,Δ |
| **APD-ULP20** | 20 | 18 | 69.4 | 30.1 | 60.1 | 62.5 | 27.1 | 54.1 | Three phase,Wye,Yn,Δ |
| **APD-ULP28** | 28 | 26 | 97.2 | 42.1 | 84.2 | 90.2 | 39.1 | 78.2 | Three phase,Wye,Yn,Δ |
| **APD-ULP30** | 30 | 27 | 104.1 | 45.1 | 90.2 | 93.7 | 40.6 | 81.2 | Three phase,Wye,Yn,Δ |
| **APD-ULJ30** | 30 | 27 | 104.1 | 45.1 | 90.2 | 93.7 | 40.6 | 81.2 | Three phase,Wye,Yn,Δ |
| **APD-ULJ40** | 40 | 36 | 138.8 | 60.1 | 120.3 | 124.9 | 54.1 | 108.3 | Three phase,Wye,Yn,Δ |
| **APD-ULJ55** | 55 | 50 | 190.8 | 82.7 | 165.4 | 173.5 | 75.2 | 150.4 | Three phase,Wye,Yn,Δ |
| **APD-ULP56** | 56 | 51 | 194.3 | 84.2 | 168.4 | 177 | 76.7 | 153.4 | Three phase,Wye,Yn,Δ |
| **APD-ULJ65** | 65 | 59 | 225.5 | 97.7 | 195.5 | 204.7 | 88.7 | 177.4 | Three phase,Wye,Yn,Δ |
| **APD-ULP65** | 65 | 59 | 225.5 | 97.7 | 195.5 | 204.7 | 88.7 | 177.4 | Three phase,Wye,Yn,Δ |
| **APD-ULJ80** | 80 | 72 | 277.6 | 120.3 | 240.6 | 249.8 | 108.3 | 216.5 | Three phase,Wye,Yn,Δ |
| **APD-ULP82** | 82 | 73 | 284.5 | 123.3 | 246.6 | 253.3 | 109.8 | 219.5 | Three phase,Wye,Yn,Δ |
| **APD-ULJ100** | 100 | 90 | 347 | 150.4 | 300.7 | 312.3 | 135.3 | 270.6 | Three phase,Wye,Yn,Δ |
| **APD-ULP100** | 100 | 90 | 347 | 150.4 | 300.7 | 312.3 | 135.3 | 270.6 | Three phase,Wye,Yn,Δ |
| **APD-ULJ125** | 125 | 113 | 433.7 | 187.9 | 375.9 | 392.1 | 169.9 | 339.8 | Three phase,Wye,Yn,Δ |
| **APD-ULJ150** | 150 | 135 | 520.5 | 225.5 | 451.1 | 468.4 | 203 | 406 | Three phase,Wye,Yn,Δ |
| **APD-ULP150** | 150 | 135 | 520.5 | 225.5 | 451.1 | 468.4 | 203 | 406 | Three phase,Wye,Yn,Δ |
| **APD-ULP178** | 178 | 161 | 617.6 | 267.6 | 535.3 | 558.6 | 242.1 | 484.1 | Three phase,Wye,Yn,Δ |
| **APD-ULJ180** | 180 | 162 | 624.6 | 270.6 | 541.3 | 562.1 | 243.6 | 487.2 | Three phase,Wye,Yn,Δ |
| **APD-ULJ200** | 200 | 182 | 694 | 300.7 | 601.4 | 631.5 | 273.6 | 547.3 | Three phase,Wye,Yn,Δ |
| **APD-ULP200** | 200 | 182 | 694 | 300.7 | 601.4 | 631.5 | 273.6 | 547.3 | Three phase,Wye,Yn,Δ |
| **APD-ULP250** | 250 | 227 | 867.4 | 375.9 | 751.8 | 787.6 | 341.3 | 682.6 | Three phase,Wye,Yn,Δ |
| **APD-ULJ250** | 250 | 227 | 867.4 | 375.9 | 751.8 | 787.6 | 341.3 | 682.6 | Three phase,Wye,Yn,Δ |
| **APD-ULV250** | 250 | 227 | 867.4 | 375.9 | 751.8 | 787.6 | 341.3 | 682.6 | Three phase,Wye,Yn,Δ |
| **APD-ULJ275** | 275 | 250 | 954.2 | 413.5 | 827 | 867.4 | 375.9 | 751.8 | Three phase,Wye,Yn,Δ |
| **APD-ULJ300** | 300 | 275 | 1040.9 | 451.1 | 902.1 | 954.2 | 413.5 | 827 | Three phase,Wye,Yn,Δ |
| **APD-ULP300** | 300 | 275 | 1040.9 | 451.1 | 902.1 | 954.2 | 413.5 | 827 | Three phase,Wye,Yn,Δ |
| **APD-ULV300** | 300 | 275 | 1040.9 | 451.1 | 902.1 | 954.2 | 413.5 | 827 | Three phase,Wye,Yn,Δ |
| **APD-ULJ350** | 350 | 320 | 1214.4 | 526.2 | 1052.5 | 1110.3 | 481.1 | 962.3 | Three phase,Wye,Yn,Δ |
| **APD-ULP350** | 350 | 320 | 1214.4 | 526.2 | 1052.5 | 1110.3 | 481.1 | 962.3 | Three phase,Wye,Yn,Δ |
| **APD-ULV350** | 350 | 320 | 1214.4 | 526.2 | 1052.5 | 1110.3 | 481.1 | 962.3 | Three phase,Wye,Yn,Δ |
| **APD-ULJ400** | 400 | 350 | 1387.9 | 601.4 | 1202.8 | 1214.4 | 526.2 | 1052.5 | Three phase,Wye,Yn,Δ |
| **APD-ULP400** | 400 | 350 | 1387.9 | 601.4 | 1202.8 | 1214.4 | 526.2 | 1052.5 | Three phase,Wye,Yn,Δ |
| **APD-ULV400** | 400 | 350 | 1387.9 | 601.4 | 1202.8 | 1214.4 | 526.2 | 1052.2 | Three phase,Wye,Yn,Δ |
| **APD-ULP461** | 461 | 410 | 1599.6 | 693.1 | 1386.3 | 1422.6 | 616.5 | 1232.9 | Three phase,Wye,Yn,Δ |
| **APD-ULJ500** | 500 | 450 | 1734.9 | 751.8 | 1503.6 | 1561.4 | 676.6 | 1353.2 | Three phase,Wye,Yn,Δ |
| **APD-ULV500** | 500 | 450 | 1734.9 | 751.8 | 1503.6 | 1561.4 | 676.6 | 1353.2 | Three phase,Wye,Yn,Δ |
| **APD-ULP512** | 512 | 467 | 1776.5 | 769.8 | 1539.6 | 1620.4 | 702.2 | 1404.3 | Three phase,Wye,Yn,Δ |
| **APD-ULP565** | 565 | N/A | 1960.4 | 849.5 | 1699 | N/A | N/A | N/A | Three phase,Wye,Yn,Δ |
| **APD-ULV550** | 550 | | 1908 | 827 | 1654 | | | | Three phase,Wye,Yn,Δ |
| **APD-ULV600** | 600 | | 2082 | 902 | 1804 | | | | Three phase,Wye,Yn,Δ |
| **APD-ULP611** | 611 | 555 | 2120 | 918.7 | 1837.4 | 1925.7 | 834.5 | 1669 | Three phase,Wye,Yn,Δ |
| **APD-ULM800** | 800 | 720 | 2776 | 1203 | 2406 | 2498 | 1083 | 2165 | Three phase,Wye,Yn,Δ |
| **APD-ULM1000** | 1000 | 910 | 3470 | 1503 | 3007 | 3157 | 1368 | 2736 | Three phase,Wye,Yn,Δ |
| **APD-ULM-1250** | 1250 | 1125 | N/A | 1879 | N/A | N/A | 1692 | N/A | Three phase,Wye,Yn,Δ |
| **APD-ULM-1600** | 1600 | 1450 | N/A | 2406 | N/A | N/A | 2180 | N/A | Three phase,Wye,Yn,Δ |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **APD-ULM-2000** | 2000 | 1800 | N/A | 3007 | N/A | N/A | 2706 | N/A | Three phase,Wye,Yn,Δ |

| | STANBY (Kw) | PRIME (kW) | STANDBY RATING AMPS 120/240 1P | PRIME RATING AMPS 120/240 1P | Phase Configuration |
|---|---|---|---|---|---|
| **APD-ULP9** | 9 | 8 | 37.5 | 33.3 | Single Phase |
| **APD-ULP13** | 13 | 12 | 54.2 | 50 | Single Phase |
| **APD-ULP20** | 20 | 18 | 83.3 | 75 | Single Phase |
| **APD-ULP28** | 28 | 26 | 116.7 | 108.3 | Single Phase |
| **APD-ULP30** | 30 | 27 | 125 | 112.5 | Single Phase |
| **APD-ULJ30** | 30 | 27 | 125 | 112.5 | Single Phase |
| **APD-ULJ40** | 40 | 36 | 166.7 | 150 | Single Phase |
| **APD-ULJ55** | 55 | 50 | 229.2 | 208.3 | Single Phase |
| **APD-ULP56** | 56 | 51 | 233.3 | 212.5 | Single Phase |
| **APD-ULJ65** | 65 | 59 | 270.8 | 245.8 | Single Phase |
| **APD-ULP65** | 65 | 59 | 270.8 | 245.8 | Single Phase |
| **APD-ULJ80** | 80 | 72 | 333.3 | 300 | Single Phase |
| **APD-ULP82** | 82 | 73 | 341.7 | 304.2 | Single Phase |
| **APD-ULJ100** | 100 | 90 | 416.7 | 375 | Single Phase |
| **APD-ULP100** | 100 | 90 | 416.7 | 375 | Single Phase |
| **APD-ULJ125** | 125 | 113 | 520.8 | 470.8 | Single Phase |
| **APD-ULJ150** | 150 | 135 | 625 | 562.5 | Single Phase |
| **APD-ULP150** | 150 | 135 | 625 | 562.5 | Single Phase |

# 4. INSTALLATION, HANDLING AND STORAGE

### 4.1 General

Once the size of the generation set and any associated control systems of switchgear have been established, plans for installation can be prepared. This section discusses factors considered important for the effective and safe installation of the generating set.

### 4.2 Canopies

Installation and handing is simplified when the generating set has been equipped with a canopy. The canopy also gives protection from the elements and protection from unauthorized access.

### 4.3 Moving the Generating Set

The generating set base frame is specifically designed for ease of moving the set. Improper handing can seriously damage components.

Using a forklift, the generating set can be lifted or carefully pushed/pulled by the base frame directly using the forks. Always use wood between forks and the base frame the spread the load and prevent damage.

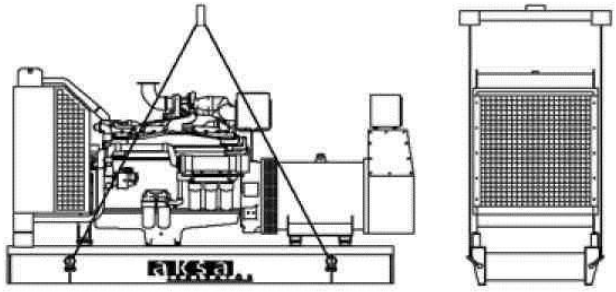


Figure 4.1 Lifting generating set by using a winch

**Warning**

! Never lift the generating set by attaching rigging to the engine or alternator lifting lugs.

! Ensure the lifting rigging and supporting structure is in good condition and is suitably rated.

! Keep all personnel away from the generating set while it is suspended.

! If the generating set is going to be lifted, it should be lifted by the lifting points fitted on canopied sets and most open sets.

### 4.4. Location

In order to start consideration for the possible layouts at a site, the following criteria must first be determined:

-The total area available and any restrictions within that area (i.e. buried or overhead services)

-A forced ventilation system is required for the equipment, which draws sufficient cooling and aspiration air into the room at the back of the alternator and discharges the air from the front of the engine. Depending upon the layout of the building, it may be necessary to install additional ductwork to achieve the airflow required.

-The access into the building, initially for the delivery and installation of the equipment, and afterwards for servicing and maintenance of the equipment.

-Protection from the elements such ad rain, snow, sleet wind-driven precipitation, flood water, direct sunlight, freezing temperatures, or excessive heat.

-Protection from exposure to airborne contaminants such as abrasive or conductive dust, lint, smoke, oil mist, vapors, engine exhaust fumes, or other contaminants.

-Protection from the impact of falling objects such as trees or poles, from motor vehicles, or from lift trucks.

-Clearance around the generating set for cooling and service access: at least 3.3 feet around the set and at least 6.6 feet of headroom above the set.

-Access to move the entire generating set into the room. Air inlet and outlet vents can often be made removable to provide an access point. Access to unauthorized personnel should be limited.

-If it is necessary to locate the generating set outside of the building, the generating set should be enclosed in a canopy. A canopy is also useful for temporary installations inside or outside of the building.

### 4.5. Base and Foundation

Note: Special foundations are unnecessary. A level and sufficiently strong concrete floor is adequate. The responsibility for the foundation (including seismic considerations) should be placed with a civil or structural engineer specializing in this type of work.

Major functions of a foundation are to:

Support the total weight of the generating set. Considering the vibration by the generating set, it should be isolated from surrounding structures.

To support the structural design, the civil engineer will need the following details:

- -The plant’s operating temperatures.
- -The overall dimensions of the proposed foundation mass.
- -The mounting and fixing arrangements of the generator bed-frame.

Concrete Foundations:

The foundation will require at least seven days between pouring the concrete and mounting the generating set to cure. It is also essential that the foundation be level, preferably within ±0.5°of any horizontal plane and should rest on undisturbed soil.

The following formula may be used to calculate the minimum foundation depth:

$$t = \frac{k}{d \times w \times l}$$

t=thickness of foundation in ft
k=net weight of set in lbs
d=density of concrete (take 150 lb/ft3)
w=width of foundation in (ft)
l=length of foundation in (ft)

The foundation strength may still vary depending on the safe bearing capacity of supporting materials and the soil bearing load of the installation site. Therefore, reinforced gauge steel wire mesh, reinforcing bars, or some equivalent may be required.

**Vibration Isolation**

Each generating set is built as single module with the engine and alternator coupled together through a coupling chamber. This chamber utilizes resilient mounting to form one unit of immense strength and rigidity. This provides both accuracy of alignment between the engine and alternator and damping of engine vibration. This reduces the need for heavy concrete foundations that would normally be used to absorb engine vibrations so that all the generator required is a level concrete floor to take the distributed weight of the unit.

**Foundation**

A reinforced concrete pad provides a rigid support to prevent deflection and vibration. Typically, the foundation should be 6 to 8 inches (150 mm to 200 mm) deep and at least as wide and long as the generating set. The ground or floor below the foundation should be properly prepared and structurally suited to carry the weight of the foundation pad and the generating set. (If the generating set is to be installed above the ground floor, the building structure must be able to support the weight of the generating set, fuel storage, and accessories). If there is a chance that moisture will accumulate on the floor such as in a boiler room, the pad should be raised above the floor. This will provide a dry footing for the generating set and for those who connect, service, or operate it. It will also minimize corrosive action on the base-frame.

**Levelling**

A poor foundation may result in unnecessary vibration of the genset.

**Connections**

All piping and electrical connections should be flexible to prevent any damage caused by movement of the generation set. Fuel and water lines, exhaust pipes and conduit can transmit vibrations at long distances.

### 4.6. Room Design Guidance Notes

#### 4.6.1. Room Size Allowance

The dimensions as indicated in A & B allow for good maintenance/escape access around the generator. Ideally, a minimum distance of 30 inches should be allowed from any wall, tank or panel within the room.

#### 4.6.2. Inlet and Outlet Attenuators with Weather Louvers

The inlet and outlet attenuators should be installed within a wooden frame. The attenuators are based off of 4-inch airways and 8-inch acoustic modules. The attenuators should be fitted with weather louvers with a minimum of 50% free area, good airflow profile, and afford low restriction airflow access.

The weather louvers should have bird/vermin mesh screens fitted on the inside, but these screens must not impede the free flow of cooling and aspiration air. The outlet attenuator should be connected to the radiator ducting flange with a heat and oil resistant flexible connection.

#### 4.6.3. Combustion Air Inlet

Air for engine combustion must be as clean and as cool as possible, Normally, this air can be drawn from the area surrounding the generating set via the engine-mounted air filter. However, in some cases due to dust, dirt, or heat, the air around the set is unsuitable. In these cases, an inlet duct should run from the source of clean air (outside the building, another room, etc) to the engine –mounted air filter. Do not remove the air filter and mount it at a remote location as this can increase the possibility of dirt leaking through the ductwork and into the engine inlet.

#### 4.6.4. Exhaust Systems

The exhaust systems shown on the layout drawings are supported by the ceiling. Should the building construction be such that the roof supports are unable to support the exhaust system, a system of support coming up from the floor will be needed for the steel exhaust. Exhaust pipes should terminate at least 7.5ft above floor level to make it reasonably safe for anyone passing by.

It is recommended that stainless steel bellows be fitted to the engine exhaust manifold followed by rigid pipe work to the silencer.

It is good installation practice for the exhaust system within the generator room to be insulated with a minimum of 2-inches. Of high- density, high-temperature mineral insulation covered by an aluminum overclad. This reduced the possibility of operator bum injury and reduces the heat being transferred to the operating generator room.

#### 4.6.5. Cooling and Ventilation

The engine, alternator, and exhaust pipes radiate heat which may result in temperatures high enough to adversely affect the performance of the generating set. It is, therefore, important that adequate ventilation is provided to keep the engine and alternator cool. Proper air flow, as shown in Figure 4.4., requires that the air comes in at the alternator end of the set, passes over the engine, through the radiator, and out of the room via a flexible outside, the fan will tend to draw the hot air back through the radiator reducing the cooling effectiveness.

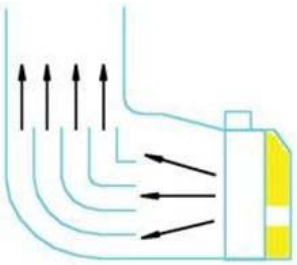


Figure 4.2 Directing the air thrown from the radiator with deviating wings.

Sharp corners on the radiator hot air out let channel or its chimney must be avoided. Sharp corners can cause vented air to become trapped and recirculated reduce effectiveness of the cooling cycle (Figure 4.2. and 4.3.).

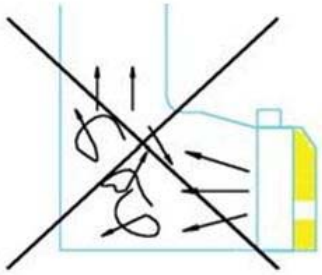


Figure 4.3 Weak ventilation

The air inlet and outlet openings should be large enough to ensure free flow of air into and out of the room. A good estimation for the openings would be to make them at least 1.5 times the area of the radiator core.

Both the inlet and outlet openings should have louvers for weather protection. These may be fixed, but preferably, should be movable in cold climates so that while the generating set is not operating the louvers can be closed. This will allow the room to be kept warm which will assist with starting and load acceptance. For automatically starting generating sets, If the louvers are movable, they must be automatically operated. They should be programmed to open immediately upon starting the engine.

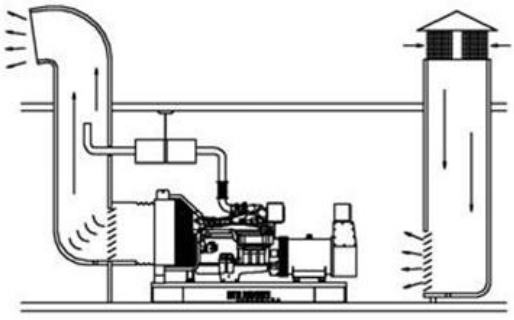


Figure 4.4 Air ventilation

#### 4.6.6. Cable Systems

The layout drawing assumes that the change-over switch-gear is external to the generator room and located in the power distribution room. Specific project requirements can affect this layout.

The power output cables from the generator output breaker to the distribution panel must be a flexible type. The flexible power cables as installed should be laid up in trefoil, placed on support trays/ladder rack in the trench with the recommended inter-spacing, and segregated from the system control cables.

The cables should be correctly supported and rated for the installation/ambient conditions.

The flexible single core power cables, when entering any panel, must pass through a non-ferrous gland plate.

#### 4.6.7. Change – Over Panels

For change-over cubicles rated up to 400 Amp, the wall mounting panel with a maximum depth of 13-3/4 inches can be mounted directly above the cable trench on the side. For change-over cubicles rated at 800 Amp and higher, a floor standing panel is used which needs additionally allocated space. A minimum of 31-1/2 inches should be allowed for rear access.

#### 4.6.8. Doors

Doors should always open outwards. Make any necessary allowance for the generator to be moved into the room by using double doors at the attenuator space.

#### 4.6.9. Inlent and Outlet Louvers

The inlet and outlet weather louvers should be installed within a wooden frame having a minimum 50% free area, good airflow profile, and low restriction airflow access.

The weather louvers should have bird/vermin mesh screens fitted on the inside, but must not impede the free flow of cooling and aspiration air.

The outlet weather louver should be connected to the radiator ducting flange with a heat and oil resistant flexible connection.

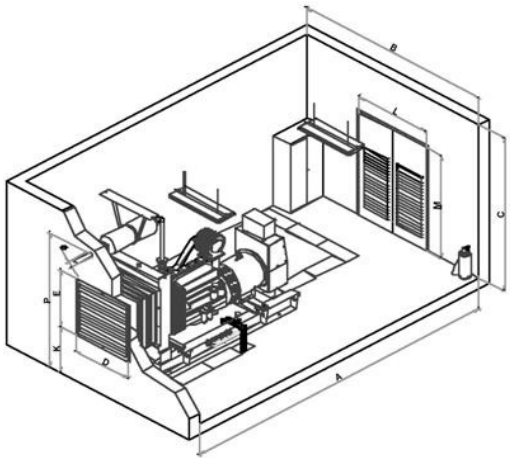


Figure 4.5 Generating set room

| Genset | | Generating Set Dimensions(ft) | | | Room dimensions(ft) | | | Radiator Hot Air Outlet Openings Louvers (ft) | | | Air Inlet Openings Total Area (ft2) | Room's Door Dimensions(ft) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | open | | | | | | | | | | | |
| Model | Standby Power (kW) | Length | Width | Height | Length | Width | Height | D | E | K | ft2 | W | H |
| APD-ULP9 | 9 | 4.59 | 2.58 | 3.03 | 11 | 9 | 9.6 | 2.3 | 2.46 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULP13 | 13 | 4.59 | 2.58 | 3.22 | 11 | 9 | 9.6 | 2.3 | 2.46 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULP20 | 20 | 6 | 3.28 | 3.18 | 12.56 | 9.8 | 9.6 | 2.3 | 2.46 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULP28 | 28 | 6 | 3.28 | 3.6 | 12.56 | 9.8 | 9.6 | 2.3 | 2.46 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULJ30 | 30 | 6 | 3.28 | 3.72 | 12.56 | 9.8 | 9.6 | 2.3 | 2.46 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULP30 | 30 | 6 | 3.28 | 3.68 | 12.56 | 9.8 | 9.6 | 2.3 | 2.46 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULJ40 | 40 | 6 | 3.28 | 3.72 | 12.56 | 9.8 | 9.6 | 2.3 | 2.62 | 1.64 | 8.6 | 6.6 | 7.22 |
| APD-ULJ55 | 55 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.3 | 2.62 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULP56 | 56 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.3 | 2.62 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULJ65 | 65 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.46 | 2.62 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULP65 | 65 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.46 | 2.62 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULJ80 | 80 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.46 | 2.62 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULP82 | 82 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.46 | 2.62 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULP100 | 100 | 7.67 | 3.61 | 4.46 | 14.23 | 10 | 9.6 | 2.62 | 2.95 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULJ100 | 100 | 9.64 | 3.61 | 4.46 | 17.8 | 10 | 9.6 | 2.62 | 2.95 | 1.64 | 10.76 | 6.6 | 7.22 |
| APD-ULJ125 | 125 | 9.64 | 3.61 | 4.46 | 17.8 | 10 | 9.6 | 2.62 | 2.95 | 1.64 | 16.13 | 6.6 | 7.22 |
| APD-ULJ150 | 150 | 9.64 | 3.61 | 4.46 | 17.8 | 10 | 9.6 | 3.61 | 3.28 | 1.97 | 16.13 | 6.6 | 7.22 |
| APD-ULP150 | 150 | 9.64 | 3.61 | 4.46 | 17.8 | 10 | 9.6 | 3.61 | 3.28 | 1.97 | 16.13 | 6.6 | 7.22 |
| APD-ULP178 | 178 | 9.64 | 3.61 | 4.46 | 17.8 | 10 | 9.6 | 3.61 | 3.28 | 1.97 | 16.13 | 6.6 | 7.22 |
| APD-ULJ180 | 180 | 9.64 | 3.61 | 4.46 | 17.8 | 10 | 9.6 | 3.61 | 3.28 | 1.97 | 16.13 | 6.6 | 7.22 |
| APD-ULP200 | 200 | 10.5 | 4.59 | 5.22 | 18.7 | 12.8 | 9.6 | 3.61 | 3.28 | 1.97 | 16.13 | 6.6 | 7.22 |
| APD-ULJ200 | 200 | 10.5 | 4.59 | 5.22 | 18.7 | 12.8 | 9.6 | 3.61 | 3.28 | 1.97 | 16.13 | 6.6 | 7.22 |
| APD-ULJ250 | 250 | 10.5 | 4.59 | 5.22 | 18.7 | 12.8 | 9.6 | 2.46 | 2.62 | 1.64 | 16.13 | 6.6 | 7.22 |
| APD-ULV250 | 250 | 10.5 | 4.59 | 5.22 | 18.7 | 12.8 | 9.6 | 2.46 | 2.62 | 1.64 | 16.13 | 6.6 | 7.22 |
| APD-ULJ275 | 275 | 10.5 | 4.59 | 5.22 | 18.7 | 12.8 | 9.6 | 2.46 | 2.62 | 1.64 | 16.13 | 6.6 | 7.22 |
| APD-ULJ300 | 300 | 13.12 | 6.23 | 5.92 | 23 | 16 | 12.7 | 2.46 | 2.62 | 1.64 | 38.73 | 8 | 8 |
| APD-ULP300 | 300 | 13.12 | 6.23 | 6.12 | 23 | 16 | 12.7 | 2.46 | 2.62 | 1.64 | 38.73 | 8 | 8 |
| APD-ULV300 | 300 | 13.12 | 6.23 | 6.12 | 23 | 16 | 12.7 | 2.46 | 2.62 | 1.64 | 38.73 | 8 | 8 |
| APD-ULJ350 | 350 | 13.12 | 6.23 | 5.92 | 23 | 16 | 12.7 | 2.46 | 2.62 | 1.64 | 38.73 | 8 | 8 |
| APD-ULP350 | 350 | 13.12 | 6.23 | 6.12 | 23 | 16 | 12.7 | 2.46 | 2.62 | 1.64 | 38.73 | 8 | 8 |
| APD-ULV350 | 350 | 13.12 | 6.23 | 6.12 | 23 | 16 | 12.7 | 2.46 | 2.62 | 1.64 | 38.73 | 8 | 8 |
| APD-ULJ400 | 400 | 13.12 | 6.23 | 5.92 | 23 | 16 | 12.7 | 2.62 | 2.95 | 1.64 | 38.73 | 8 | 8 |
| APD-ULP400 | 400 | 13.12 | 6.23 | 6.12 | 23 | 16 | 12.7 | 2.62 | 2.95 | 1.64 | 38.73 | 8 | 8 |
| APD-ULV400 | 400 | 13.12 | 6.23 | 6.12 | 23 | 16 | 12.7 | 2.62 | 2.95 | 1.64 | 38.73 | 8 | 8 |
| APD-ULP461 | 461 | 13.12 | 6.23 | 6.1 | 23 | 16 | 12.7 | 2.62 | 2.95 | 1.64 | 38.73 | 8 | 8 |
| APD-ULJ500 | 500 | 13.12 | 6.23 | 5.92 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULV500 | 500 | 13.12 | 6.23 | 5.92 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULP512 | 512 | 13.12 | 6.23 | 6.1 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULV550 | 550 | 13.12 | 6.23 | 6.1 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULP565 | 565 | 13.12 | 6.23 | 6.1 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULV600 | 600 | 13.12 | 6.23 | 6.1 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULP611 | 611 | 13.12 | 6.23 | 6.22 | 23 | 16 | 12.7 | 3.61 | 3.28 | 1.97 | 38.73 | 8 | 8 |
| APD-ULM800 | 800 | 16.41 | 7.42 | 6.93 | 29.5 | 20.5 | 14.8 | NA | NA | NA | NA | 10 | 9.2 |
| APD-ULM1000 | 1000 | 17.39 | 7.42 | 7.39 | 30.5 | 20.5 | 15.6 | NA | NA | NA | NA | 10 | 10 |
| APD-ULM1250 | 1250 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| APD-ULM1600 | 1600 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| APD-ULM2000 | 2000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

# 5. FUEL SYSTEM

### 5.1. General

Depending upon the specific site layout, the fuel can be supplied to the engine either from:

1. The sub-base fuel tank located under the generating set.
2. An intermediate daily service tank located within the plant room or generator enclosure which will be automatically refilled from a bulk storage tank.
3. Directly from the bulk storage tank provided that the outlet connection from this tank is at least 20 inches higher than the base upon which the generator is mounted.

It is very important that the fuel oil purchased for use in any engine be as clean and water-free as possible. Dirt in the fuel can clog injector outlets and ruin the finely machined precision parts in the fuel injection system. Water in the fuel will accelerate corrosion of these parts.

### 5.2. Diesel Fuel Recommendations

The following fuel oil specification is typical

**Diesel Fuel Recommended Physical Properties Specifications.**

| | |
|---|---|
| Viscosity(ASTM D445) | 1.3 to 5.8 centi strokes(0.05 to 0.23 in per second) at 104℉(1048F) |
| Cetane Number(ASTM D613) | 40 Minimum above 32℉(0℃)<br>45 Minimum above 32℉(0℃) |
| Sulphur Content | Not to exceed 0.5 mass percent |
| (ASTM D1796) | Not to exceed 0.05 volume percent |
| Density(ASTM D287) | 42 to 30 API GRAVITY AT 60℉(0.816 to 0.876 g/cc at 15℃) |
| Cloud Point(ASTM D287) | 10℉(6℃) below lowest ambient temperature at which the fuel is expected to operate |
| Ash(ASTM D482) | Not to exceed 0.02 mass percent(0.05 mass percent with lubricating oil blending) |
| Lubricity | 3100 grams or greater |

Table 5.1

**Diesel Fuel Property Definition**

Ash – Mineral residue in fuel. High ash content leads to excessive oxide build-up in the cylinder and/or injector. Cetane Number – Ignitability of fuel. The lower the cetane number is, the harder it is to start and run the engine. Low cetane fuels ignite later and burn slower. This could lead to explosive detonation by having excessive fuel in the chamber at the time of ignition. In cold water or with prolonged low loads, a higher cetane number is desirable.

**Cloud and Pour Points** – The pore point is the temperature at which the fuel will not flow. The cloud point is the temperature at which the wax crystals separate from the fuel.

The pour point should be at least 6℃（10℉）below the ambient temperature to allow the fuel to move through the lines. The cloud point must be no more than 6℃（10℉）above the pour point so the wax crystals will not settle out of the fuel and plug the filtration system.

**Sulfur** – The amount of sulfur residue in the fuel. The sulfur combines with the moisture formed during combustion to form sulfuric acid.

**Viscosity** – Influences the size of the atomized droplets during injection. Improper viscosity can lead to detonation, power loss, and excessive smoke. Fuels that meet the requirements of ASTM or 2.0 diesel fuels are satisfactory with fuel systems.

### 5.3. Base Fuel Tank

Generating sets up to 2000Kw can be supplied with or without base fuel tanks. The room height should allow for this feature.

Recommended room layout drawings incorporate base fuel tanks on the generators.

This provides a self-contained installation without the addition of external fuel lines, trenches, or fuel transfer pumps. Generators with base tanks are delivered fully connected and ready to run.

### 5.4. Bulk Storage Tanks

The purpose of the fuel-supply system is to store an adequate quantity of fuel to suit the application for which the system is intended. The bulk storage tanks should be sized accordingly.

The filling of the tanks will be by means of a fill connection housed in a suitable, lockable, cabinet located so as to permit easy access by any means of fuel delivery. This cabinet may also house a contents gauge and an overfill alarm connected to the float switch inserted into a manhole on the tank.

**5.5. Without Intermediate Fuel Tank (Fig.5.1.)**

The simplest arrangement would be supply the engine directly from the bulk storage tank and return the infector spill directly to this tank. A typical arrangement for this is shown if Fig.5.1. The principle limitations of this method are: In order to gravity feed the engine, the outlet from the bulk storage tank must be a minimum of 23-5/8 inches above the generator plinth level; The pressure drop of the spill return pipe work must not exceed that detailed in the Engine Data sheet; The supply pipe work from the bulk storage tank to the engine must be sized to allow the total volume of fuel required by the engine to flow under gravity.

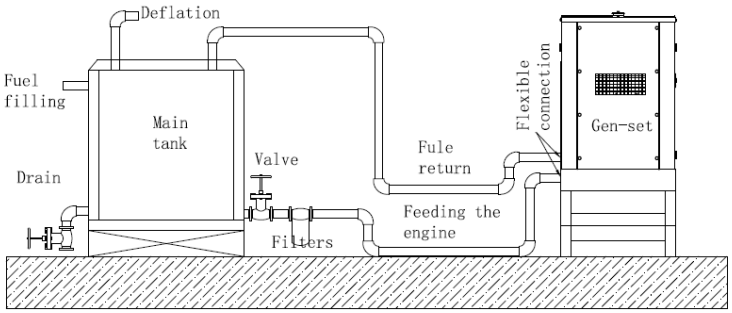



Figure 5.1 Without Intermediate Fuel Tank

**5.6. With Intermediate Fuel Tank (Fig.5.2)**

Where it is not possible to supply the engine direct from the bulk tank due to site constraints, an intermediate tank can be located within the plant room/generator enclosure which supplies fuel directly to the engine.

This type of system can be further enhanced by the addition of the following optional items of equipment:

1. An automatic duplex fuel transfer pump and primary filter system arranged to start the standby pump should the duty pump fail. The transfer pump(s) must be sized to cater for the total fuel required by the engine, i.e. fuel consumed and the spill return volumes (Fig.5.2.)
2. A fusible link operated dead weight drop valve designed to cut off the supply of fuel to the intermediate tank and to transmit a signal in the vent of fire;
3. A fusible, link operated, dump valve arranged to dump the contents of local tank back into the bulk tank in the event of a fire within the generator enclosure.

The connection details for these additional items of equipment are indicated. See Fig. 5.2.

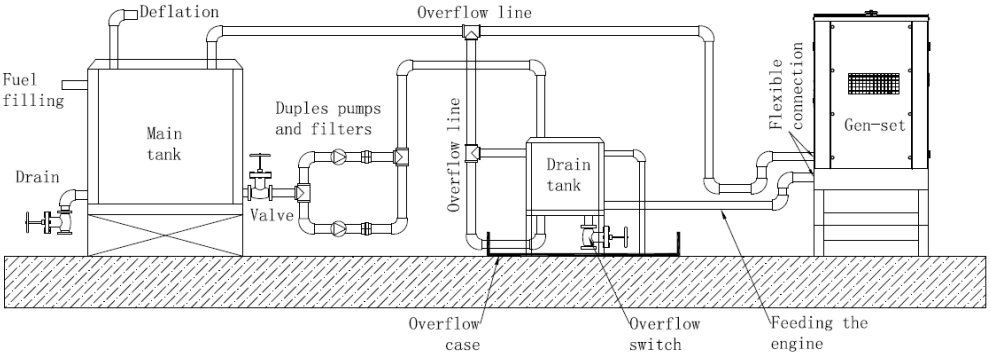



Figure 5.2 With Intermediate Fuel Tank.

**5.7. Daily Service Fuel Tank**

Separate daily service tank can be provided based on customer requirements. It would also include a transfer system arranged to automatically feed from the bulk storage tank electric, motor driven, pump(s) operating from signals from a level sensing float switch. Fuel tanks should not be made from galvanized iron as diesel fuel oil reacts against zinc.

A vent pipe should be extended to the highest point of the fuel system installation. The diameter of the pipe should at least match that of the fill connection. Provision should be made to prevent the ingress of dirt. The overflow from the daily service intermediate tank can either be:

1. Piped directly back to the bulk storage tank;
2. Piped into the bund of the intermediate tank with a bund level alarm system arranged to cut off the fuel transfer pump system upon detection of spillage.
3. Piped to overflow into the bunded area. The feed connection on the tank should not be lower than 23.6 in above the level on which the engine sits in order to maintain gravity feed to the engine. When the intermediate tank is located at a lower level than the bulk storage tank, it is essential that a solenoid valve be incorporated into the transfer line. All final connections to the engine should be in flexible hose to restrict vibration transmission through the pipe.

**5.8. Determining Pipe Sizes**

Minimum pipe sizes are determined by the size of the inlet to the fuel transfer pump. The pipe inner diameter (ID) must be a least as large as the transfer pump inlet. If the piping must carry the fuel over long distances, the pipe size must be increased. An auxiliary transfer pump at the tank outlet may also be needed to avoid high suction pressure within the piping. In all cases, excessive fuel line suction pressures must be avoided. At high suction pressures, the fuel will vaporize in the piping and the fuel supply to the engine will be decreased. When sizing piping, always remember to account for pressure drop across filters, fittings, and restriction valves. A flex connector must be added to isolate the engine vibration from the fuel piping. If this vibration is not isolated, the piping could rupture and leak. The flexible connector must be as close to the engine transfer pumps as possible. Any expanse of exposed piping must be properly supported to prevent piping ruptures.

Use pipe hangers to isolate vibration from the system. Exposed fuel piping must never run near heating pipes, furnaces, electrical wiring, or exhaust manifolds. The area around the piping is warm, the fuel lines should be insulated to prevent the fuel and piping from picking up any excess heat. All pipes should be inspected for leaks and general condition including cleanliness before installation. Back flush all lines to the tank before start-up to avoid pulling excess dirt into the engine and fuel piping system. After installation, the air should be bled from the fuel system. A hand valve should be included at some high point in the system to allow air removal. Use plugged tees, not elbows, to make piping bends. This will allow for cleaning by removing the plugs and flushing out the lines. All threaded pipe fittings must be sealed with a suitable paste.

Caution: Do not use tape to seal fuel line fittings. Pieces of tape could shear off and jam in the pump or injectors. Inlet minimum and maximum pressure at the point of connection to the supply piping for units that require a pressurized fuel input is 2.6-0.3PSI.

**5.9. Fuel Return Lines**

Fuel return lines take the hot excess fuel not used in the engine cycle away from the injectors and back to either the fuel storage tank or the day tank. The heat from the excess fuel is dissipated in the tank.

Caution: Never run a fuel return line directly back to the engine fuel supply lines. The fuel will overheat and break down.

The fuel return lines should always enter the storage or day tank above the highest fuel level expected. This statement is true for all powered engines with the PT fuel system. The fuel return line should never be less than one pipe size smaller than the fuel supply line.

**WARNING**

- The fuel must be clean and must not contain any water.
- Do not use galvanized pipe for fuel pipe.
- When the engine stops, there should not be any gravitational free flow in the fuel pipes towards in the direction of the engine.
- The fuel temperature is a critical factor for appropriate working conditions of the engine. Fuel temperatures above 160℉, due to expansion of the fuel, will decrease the engine output power.

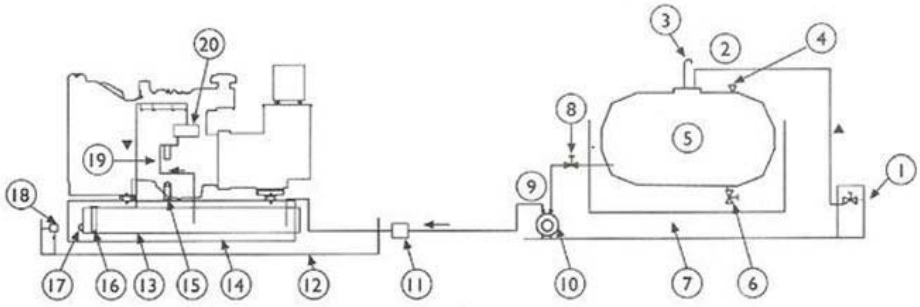
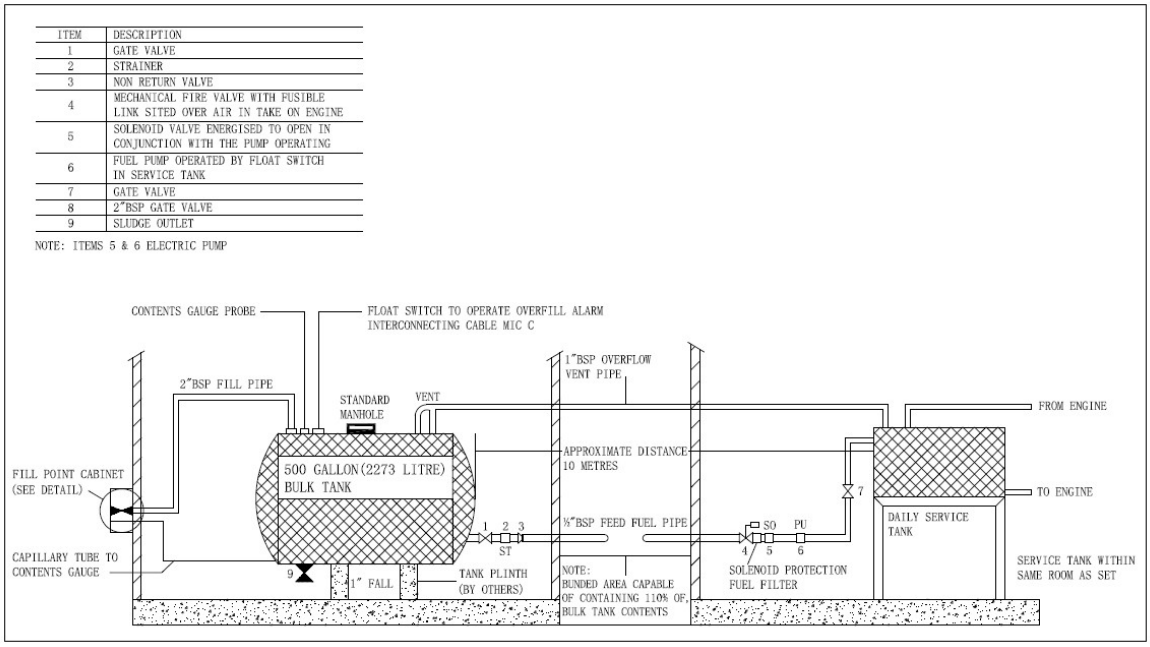



Figure 5.3. Typical fuel installation using a base tank fed from a bulk tank

- In fuel system lines, using a fuel filter will prevent the injectors and fuel pump from building up particulates and clogging. It is also useful for healthy working of the engine.

1. Fill cabinet with overfill alarm and gauge
2. Tank fill line
3. Vent line
4. Contents gauge
5. Bulk storage tank
6. Sludge drain
7. Bund tank
8. Outlet valve
9. Supply line to day tank
10. . Electric fuel transfer pump
11. . Electrical fuel shut off valve
12. . Optional band
13. . Day tank incorporated in base frame
14. . Float Control switches
15. . Manuel fill and vent
16. . Level gauge
17. . Drain
18. . Leakage alarm unit (optional)
19. . Fuel filter
20. . Engine fuel pump



| ITEM | DESCRIPTION |
|---|---|
| 1 | GATE VALVE |
| 2 | STRAINER |
| 3 | NON RETURN VALVE |
| 4 | MECHANICAL FIRE VALVE WITH FUSIBLE LINK SITED OVER AIR IN TAKE ON ENGINE |
| 5 | SOLENOID VALVE ENERGISED TO OPEN IN CONJUNCTION WITH THE PUMP OPERATING |
| 6 | FUEL PUMP OPERATED BY FLOAT SWITCH IN SERVICE TANK |
| 7 | GATE VALVE |
| 8 | 2"BSP GATE VALVE |
| 9 | SLUDGE OUTLET |

NOTE: ITEMS 5 & 6 ELECTRIC PUMP

# 6. COOLANT TREATMENT

### 6.1. General

The engine cooling system is subject to rust and cavitation. To minimize the severity of this condition, an anti-corrosive agent can be added to clean coolant water.
An anti-freeze solution is also required to prevent freezing of the coolant in the cold weather.

### 6.2. Engine Coolant

Water for coolant should be clean and free from any corrosive chemicals such as chlorides, sulphates, or acids. It should be kept slightly alkaline with a pH value ranging from 8.5 to 10.5 generally; any water that is suitable for drinking can be used, with treatment, as described below.

**Protection against corrosion**

Supplemental Coolant Additive is required to protect the cooling system from fouling, solder blooming, and general corrosion.

The use of antifreeze is also recommended as DCA4 concentrations are dependent upon the presence of antifreeze. Antifreeze also interacts with DCA4 to provide greater corrosion and protection against cavitation.

**Procedure for Treating Coolant**

1. Add the required amount of water and DCA to mixing container and mix it thoroughly.
2. Add the required amount of antifreeze, if used, to the water solution and mix thoroughly.
3. Add the coolant to the cooling system

**Cold Weather Protection**

Antifreeze must be added to the coolant to protect the engine from damage due to coolant freezing. A 1:1 water/antifreeze mixture ratio is recommended. Low- silicate antifreeze is recommended.

### 6.3. Engine Warming

There are thermostatically controlled water jacket heaters operating from the main’s supply. There are fitted into the cooling system. And they maintain the temperature of the coolant in cold weather. A heater alone, fitted in the radiator, will not be adequate for starting or preventing freezing, so an antifreeze mixture should be used.

# 7. EXHAUST SYSTEM

### 7.1. Sizing

An exhaust system should be designed to dispel the exhaust gases to atmosphere at the nearest convenient point in an installation. The length of the run and the number of changes in direction should be kept to a minimum.

The calculation of the effect on the back pressure is based upon the restriction through the straight lengths of pipe, the bends, and the silencers. The smaller the bore of the pipe is, the greater its length is, and the more times it changes its direction all increase the resistance to flow. The back pressure limit for most engines is 3 inHg (76 mmHg) Take an estimate of the size of the pipe by starting with the bore of the exhaust flange off the manifold and increasing the size by 1” for each 20 ft. length or 3 x 90 bends.

### 7.2. Routing

Once the final size and route of the pipe work and the silencer have been established, the exhaust route can be determined if the following factors are taken into consideration:

A flexible bellows unit must be fitted on the engine connection to allow the engine to move on its mountings; If the silencer is to be located within the plant room, due to its physical size and weight , it needs to be supported from the floor;

It may be necessary to install expansion joints at each change of direction to compensate for the thermal growth in the pipe during operation;

The inner radius of a 90° bend should be 3 times the diameter of the pipe See Fig. 7.1.

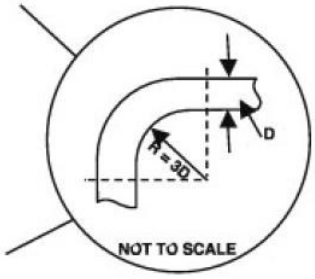



Fig. 7.1 Exhaust bend and radius

The primary silencer should be mounted as close as possible to the engine;

The termination point should not be directed at combustible materials/structures, into hazardous atmospheres containing flammable vapors, where there is a danger that the gases will re-enter the plant room through the inlet air vent, or into any opening that leads to another building in the vicinity.

All rigid pipe work should be installed in such a manner that the engine's exhaust outlet is not stressed. Pipes should be routed so that they are supported by fixtures to the building fabric or by existing structural steelwork where such methods are acceptable;

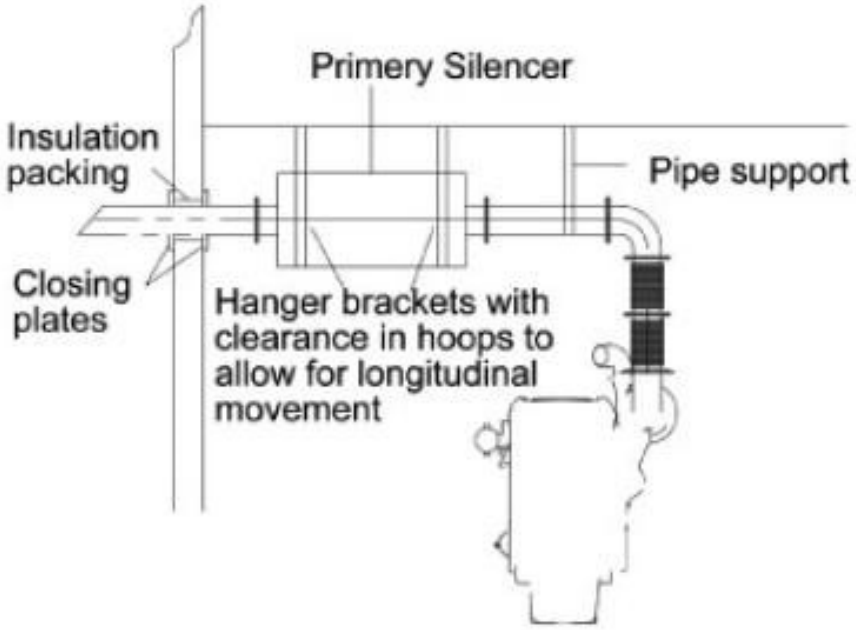



Fig. 7.2 Exhaust system

# 8. LUBRICATING OIL

The oil system of diesel engine is one of the most important elements of the engine. Proper engine maintenance (this subject includes oil change periods, filter change periods, paying attention about selecting the true type of oil ) significantly prolongs the life cost of the engine.

### 8.1. Oil Performance Properties

The American Petroleum Institute (API) the American Society for Testing and Materials (ASTM) and Society of Automotive Engineers (SAE) has developed and preserved a system in order to classify the lubrication oils for their performance categories.

### 8.2. Lubrication Recommendations for Engine

Aksa recommends that high quality multi-grade SAE 15W/40 high service engine oil in diesel engines are used. At ambient temperatures above -15°F is 15W40.

The minimum API oil quality levels recommended for use is CH / CI-4, CH or CI-4 can be used in areas where CF4 oil is not yet available, but the oil interval must be reduced API CA, CB, CC, CD, CE, CG4 categories not recommended, do not use.

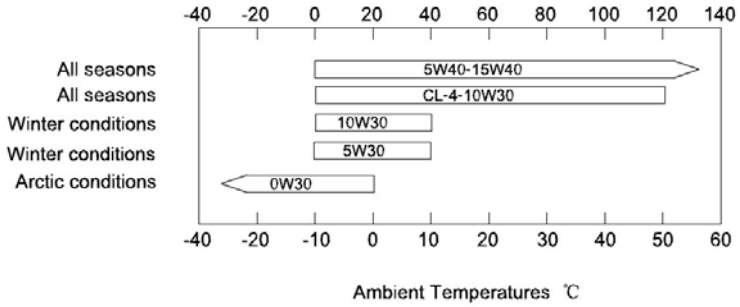



Figure: 8.1 Recommended SAE Oil Viscosity Grades vs. Ambient Temperatures

| Genset | | | Consumption at Full Load | Coolant Capacity (qt) | Oil Capacity (qt) | Note:Lubricating oil viscosity level will be choosen from table 8.1 according to the ambient temperature |
|---|---|---|---|---|---|---|
| Model | Standby Power (KW) | Engine Model | | | | |
| **APD-ULP9** | 9 | 403D-11G | 0.82 | 5.49 | 5.18 | API CH |
| **APD-ULP13** | 13 | 403D-15G | 1.14 | 6.34 | 6.34 | API CH |
| **APD-ULP20** | 20 | 404D-22G | 1.64 | 7.4 | 11.2 | API CH |
| **APD-ULP28** | 28 | 404D-22TG | 2.19 | 9.93 | 11.2 | API CH |
| **APD-ULP30** | 30 | 404D-22TAG | 2.35 | TBD | 11.2 | API CH |
| **APD-ULJ30** | 30 | 3029TFG89 | 2.59 | 6.02 | 6.34 | API CH |
| **APD-ULJ40** | 40 | 3029HFG89 | 3.54 | 6.02 | 6.34 | API CH |
| **APD-ULP56** | 56 | 1104D-44TG1 | 4.39 | 13.95 | 8.88 | API CH |
| **APD-ULJ55** | 55 | 4045TF280 | 4.6 | 8.98 | 13.74 | API CH |
| **APD-ULP65** | 65 | 1104D-E44TG1 | 4.94 | 13.95 | 8.88 | API CH |
| **APD-ULJ65** | 65 | 4045HF280 | 5.1 | 8.98 | 13.74 | API CH |
| **APD-ULJ80** | 80 | 4045HF285 | 6.6 | 8.98 | 13.74 | API CH |
| **APD-ULP82** | 82 | 1104D-E44TAG1 | 6.26 | 17.96 | 8.45 | API CH |
| **APD-ULJ100** | 100 | 4045HF285 | 8.22 | 8.98 | 13.74 | API CH |
| **APD-ULP100** | 100 | 1104D-E44TAG2 | 7.34 | 17.96 | 8.45 | API CH |
| **APD-ULJ125** | 125 | 4045HF285 | 9.85 | 8.98 | 13.74 | API CH |
| **APD-ULJ150** | 150 | 6068HF285 | 11.8 | 12.57 | 34.34 | API CH |
| **APD-ULP150** | 150 | 1106D-E66TAG3 | 10.59 | 22.19 | 17.44 | API CH |
| **APD-ULP178** | 178 | 1106D-E66TAG4 | 12.81 | 22.19 | 17.44 | API CH |
| **APD-ULJ180** | 180 | 6068HFG82 | 13.5 | 12.57 | 33.8 | API CH |
| **APD-ULJ200** | 200 | 6068HF485 | 15.4 | 12.57 | 34.34 | API CH |
| **APD-ULP200** | 200 | 1106D-E70TAG5 | 15.4 | 12.57 | TBD | API CH |
| **APD-ULJ250** | 250 | 6090HF484 | 17.99 | 16.91 | 34.34 | API CH |
| **APD-ULV250** | 250 | TAD1351GE | 210 | 21.12 | 31.6 | API CH |
| **APD-ULJ275** | 275 | 6090HFG86 | 19.6 | 16.91 | 32.76 | API CH |
| **APD-ULP300** | 300 | 2206D-E13TAG2 | 22.98 | 54.31 | 42.27 | API CH |
| **APD-ULJ300** | 300 | 6090HFG86 | 22.1 | 16.91 | 32.76 | API CH |
| **APD-ULV300** | 300 | TAD1351GE | 210 | 21.12 | 31.6 | API CH |
| **APD-ULJ350** | 350 | 6135HFG84 | 26.4 | 19.02 | 32.76 | API CH |
| **APD-ULP350** | 350 | 2206D-E13TAG2 | 22.98 | 54.31 | 42.27 | API CH |
| **APD-ULV350** | 350 | TAD1352GE | 26.8 | 25.36 | 38.0 | API CH |
| **APD-ULJ400** | 400 | 6135HF485 | 29.19 | 19.02 | 36.40 | API CH |
| **APD-ULP400** | 400 | 2206D-E13TAG3 | 24.83 | 54.31 | 42.27 | API CH |
| **APD-ULV400** | 400 | TAD1353GE | 26.8 | 25.36 | 38.0 | API CH |
| **APD-ULP461** | 461 | 2506D-E15TAG1 | 29.85 | 61.29 | 65.52 | API CH |
| **APD-ULJ500** | 500 | 6135HFG75 | 35.32 | 19.02 | 42.27 | API CH |
| **APD-ULV500** | 500 | TAD1641GE | 35.5 | 63.4 | 50.8 | API CH |
| **APD-ULP512** | 512 | 2506C-E15TAG3 | 31.96 | 61.29 | 65.52 | API CH |
| **APD-ULV550** | 550 | TAD1642GE | 38.5 | 63.4 | 50.8 | API CH |
| **APD-ULP565** | 565 | 2506C-E15TAG4 | 35.13 | 61.29 | 65.52 | API CH |
| **APD-ULP611** | 611 | 2806C-E18TAG3 | 38.3 | 64.46 | 65.52 | API CH |
| **APD-ULV600** | 600 | TWD1643GE | 163.2 | 50.72 | 50.8 | API CH |
| **APD-ULM800** | 800 | S12A2-Y2PTAW | 58.38 | 105.67 | 126.8 | API CH |
| **APD-ULM1000** | 1000 | S12H-Y2PTAW | 69.95 | 105.67 | 211.34 | API CH |

| | | | | | | |
|---|---|---|---|---|---|---|
| **APD-ULM1250** | 1250 | S12R-Y2PTAW | 90.62 | 137.37 | 190.21 | API CH |
| **APD-ULM1600** | 1600 | S16R-Y2PTAW | 114.7 | 179.64 | 243.04 | API CH |
| **APD-ULM2000** | 2000 | S16R-Y2PTAW2 | 141.07 | 179.64 | 243.04 | API CH |

Table 8.1 Fuel consumption and coolant, fuel, and lubricating oil capacities and lubricating oil systems.

# 9. ELECTRIC STARTING SYSTEMS

Electric starting systems are generally used on all gen-sets. The power source for electric starting systems is a 12 or 24 VDC battery system. The starting voltage is determined by engine size with 24 VDC being used for larger engines to reduce starting current and, hence, the cable size. Control of starting is performed via a start solenoid which is controlled by the gen-set control system.

### 9.1. Battery Systems

Batteries are of two types - lead acid and NiCad. Lead acid batteries are generally used, being the least expensive. NiCad batteries are used where longer life, etc., is required.

### 9.2. Batteries Warning

Servicing of batteries is to be performed or supervised by trained personnel with knowledge of batteries and required precautions. Keep unauthorized personnel away from batteries.

When replacing batteries, use the same number and the valve regulated (Maintenance-free) type batteries.

CAUTION- Do not dispose of any battery by setting fire to it. The battery is capable of exploding.

CAUTION- Do not open or mutilate any battery. The released electrolyte has been known to be harmful to the skin and eyes and can be fatal.

CAUTION- A battery presents a risk of electrical shock and high short circuit current. The following precautions are to be observed when working on batteries:

1. Remove watches, rings, or other metal objects.
2. Only use tools with insulated handles.

### 9.3. Battery Maintenance

- Keep the top of the battery and its terminals clean.
- Cover the battery terminals and its connections with Vaseline.
- Tighten the terminals until they do not move freely. Do not over tighten.
- Check the electrolyte level periodically. It should be approximately 3/8'' above the plates.
- Periodically check for any abrasions on the alternator belt and also check the tension. Compare the belt tension to the producer's recommendations and adjust if required.
- Periodically check to make sure that the battery is charged.

### 9.4. Maintenance Free Batteries

Ensure that all battery connections are correct and batteries are always charged.

### 9.5. Starting Aids

It is customary to keep coolant temperatures at or above104°F in order to promote quick staring on an emergency generating plant. Thermostatically controlled immersion heaters, deriving their supply from the primary source of power, are fitted into the engine cooling system to provide this heating.

### 9.6. Cold Cranking Ampere Rating of the Battery

We used battery listed below table for our standard.

| Brand | Battery model | voltage | CCA | L(in) | W(in) | H(in) | Weight(lbs) |
|---|---|---|---|---|---|---|---|
| VARTA | 6-QW-38LTHD | DC12V | 310 | 7.76 | 5.04 | 7.95 | 22.7 |
| VARTA | 6-QW-54HD | DC12V | 410 | 11.4 | 6.85 | 6.65 | 36.8 |
| VARTA | L2-400MF | DC12V | 640 | 9.49 | 6.85 | 7.4 | 34.8 |
| VARTA | 6-QW-80L | DC12V | 622 | 12 | 6.77 | 7.99 | 47.4 |

Table 9.1 Battery for starting

### 9.7. Battery Connection

When preparing to start the genset, place the battery onto battery support located on the base frame. Next, connect the battery cable to the battery. First connect positive pole, then connect the negative pole. When removing the battery, always remove the negative battery cable first.

# 10. ELECTRICAL CONNECTION

Only full qualified and experienced electrical technicians should carry out electrical installation, service, and repair work.

**Warning:**

Make electrical connections in compliance with all relevant Electrical Codes, Standards, or other requirements.

### 10.1. Cabling

Due to movement of generating sets on their vibration mounts, the electrical connection to the set should be made with flexible cable.

The cable must be suitable for the output voltage of the generating set and the rated current of the set. In determining the size, allowances should be made for ambient temperature, method of installation, proximity of other cables. etc.

All connections should be carefully checked for integrity. The current carrying capacity of power cables are given in table 10.1 and the cable cross sections which must be used according to the generating set power are given in table 10.2. On the other hand, there is one more important point to consider while selecting cable cross sections. If the distance between load and generator is too long, the voltage drop on the load side may be too high at the transient current duration. The voltage drop across a cable can be determined as follows:

$$e = \frac{x\ L\ x\ I\ x\ (R\ Cos\varphi + Sin\varphi)}{1000}$$

e = Voltage drop (V)
I = Rated current (A)
L = Length of conductors (m)
R = Resistance (**Ω**/km to VDE 0102)
X = Reactance (**Ω**/km to VDE 0102)

### 10.2. . Protection

The cables connecting the generating set with the distribution system are protected by means of a circuit breaker to automatically disconnect the set in case of overload or short circuit.

### 10.3. . Loading

When planning the electrical distribution system, it is important to ensure that a balanced load is presented to the generating set. If loading on one phase is substantially higher than the other phases, it will cause over heating in the alternator windings, imbalance in the phase output voltage, and possible damage to sensitive 3-phase equipment connected to the system. Ensure that no individual phase current exceeds the current rating of the generating set. For connection to existing distribution system, it may be necessary to reorganize the distribution system to ensure these loading factors are met.

**10.4. . Power Factor**

The power factor (Cosφ) of the connected load should be determined. Power factors below 0.8 lagging (inductive) can over load the generator. The set will provide its kilowatt rating and operate satisfactorily from 0.8 lagging to unity power factor (1.0) Particular attention must be given to installations with power factor correction equipment such as capacitors to ensure that a leading power factor is never present. This will lead to voltage instability and may result in voltage surges that may damage equipment. Generally, whenever the generating set is supplying the load, any power factor correction equipment should be switched off.

**10.5. Grounding/Earthing Requirements:**

The frame of the generating set must be connected to an earth ground. Since the set is mounted on vibration isolators, the ground connection must be flexible to avoid possible breakage due to vibration. Ground connection cables or straps should have at least full load current carrying capacity and meet applicable regulations.

**10.6. Insulation Test:**

Before starting the generating set after installation, test the insulation resistance of the windings. The Automatic Voltage Regulator (AVR) should be disconnected and the rotating diodes either shorted out with temporary links or disconnected. Any control wiring must also be disconnected.
A 500V Megger or similar instrument should be used.
Disconnect any grounding conductors connected between neutral and earth and meg an output terminal to earth.

**10.7 Fuse ratings and instructions**

| Ampere Rating | Voltage Rating | Nominal Resistance Cold Ohms | Nominal Melting Pt $A^2$ Sec. | Used for |
|---|---|---|---|---|
| 2 | 250 | 0.076 | 1.87 | Genset controller |
| 3.15 | 250 | 0.037 | 6.7 | Canopy light |
| 6 | 250 | 0.014 | 12.3 | Voltage Sensing |

Table 10.1

User can replace the fuses without tools, when replacing the fuses, it must be the same ampere Rating (UL, RC)

| Genset | | Standby load Current at 480V (single 277V) | Cable section Y V V Single core for each phase | N phase wiring harness (AWG) | Terminal Size | N | install tool |
|---|---|---|---|---|---|---|---|
| Model | Standby Power (KW) | (A) | (AWG) | | | connection bolt size | |
| APD-ULP9 | 9 | 13.5 | 13 | 13 | N/A | N/A | N/A |
| APD-ULP13 | 13 | 19.5 | 13 | 13 | N/A | N/A | N/A |
| APD-ULP20 | 20 | 30.1 | 9 | 9 | N/A | N/A | N/A |
| APD-ULP28 | 28 | 42 | 6 | 6 | N/A | M8 | 14mm spanner |
| APD-ULP30 | 30 | 45 | 6 | 6 | N/A | M8 | 14mm spanner |
| APD-ULJ30 | 30 | 45 | 6 | 6 | N/A | M8 | 14mm spanner |
| APD-ULJ40 | 40 | 60 | 10 | 10 | N/A | M8 | 14mm spanner |
| APD-ULJ55 | 55 | 83 | 2 | 2 | N/A | M8 | 14mm spanner |
| APD-ULP56 | 56 | 84 | 2 | 2 | N/A | M8 | 14mm spanner |
| APD-ULJ65 | 65 | 98 | 2 | 2 | N/A | M8 | 14mm spanner |
| APD-ULP65 | 65 | 98 | 2 | 2 | N/A | M8 | 14mm spanner |
| APD-ULJ80 | 80 | 120 | 2 | 2 | N/A | M8 | 14mm spanner |
| APD-ULP82 | 82 | 123 | 2 | 2 | N/A | M8 | 14mm spanner |
| APD-ULJ100 | 100 | 150 | 1/0 | 1/0 | N/A | M12 | 17mm spanner |
| APD-ULP100 | 100 | 150 | 1/0 | 1/0 | N/A | M12 | 19mm spanner |
| APD-ULJ125 | 125 | 188 | 2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULJ150 | 150 | 226 | 2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULP150 | 150 | 226 | 2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULP178 | 178 | 268 | 3/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULJ180 | 180 | 271 | 3/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULJ200 | 200 | 301 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULP200 | 200 | 301 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULP250 | 250 | 376 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULJ250 | 250 | 376 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULJ275 | 275 | 414 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULJ300 | 300 | 451 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| APD-ULP300 | 300 | 451 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| APD-ULJ350 | 350 | 526 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| APD-ULP350 | 350 | 526 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| APD-ULJ400 | 400 | 601 | 3*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| APD-ULP400 | 400 | 601 | 3*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| APD-ULP461 | 461 | 693 | 3*3/0 | 2*3/0 | M12 | M12 | 19mm spanner |
| APD-ULJ500 | 500 | 752 | 3*3/0 | 2*3/0 | M12 | M12 | 19mm spanner |
| APD-ULP512 | 512 | 770 | 3*3/0 | 2*3/0 | M12 | M12 | 19mm spanner |
| APD-ULP565 | 565 | 850 | 3*4/0 | 2*4/0 | M12 | M12 | 19mm spanner |
| APD-ULP611 | 611 | 919 | 3*4/0 | 2*4/0 | M12 | M12 | 19mm spanner |
| APD-ULM800 | 800 | 1203 | 4*4/0 | 2*4/0 | M12 | M12 | 19mm spanner |
| APD-ULM1000 | 1000 | 1504 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| APD-ULV250 | 250 | 376 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| APD-ULV300 | 300 | 451 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **APD-ULV350** | 350 | 526 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULV400** | 400 | 601 | 3*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULV450** | 450 | 677 | 3*3/0 | 2*3/0 | M12 | M12 | 19mm spanner |
| **APD-ULV500** | 500 | 752 | 3*3/0 | 2*3/0 | M12 | M12 | 19mm spanner |
| **APD-ULV550** | 550 | 827 | 3*4/0 | 2*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULV600** | 600 | 902 | 3*4/0 | 2*4/0 | M12 | M12 | 19mm spanner |

| Genset | | Standby load Current at 240V (single 120V) | Cable section Y V V Single core for each phase | N phase wiring harness (AWG) | Terminal Size | N | install tool |
|---|---|---|---|---|---|---|---|
| Model | StandBy Power (KW) | (A) | (AWG) | | | connection bolt size | |
| **APD-ULP9** | 9 | 27.1 | 13 | 13 | N/A | N/A | N/A |
| **APD-ULP13** | 13 | 39.1 | 11 | 11 | N/A | N/A | N/A |
| **APD-ULP20** | 20 | 60.1 | 7 | 7 | N/A | N/A | N/A |
| **APD-ULP28** | 28 | 84 | 5 | 5 | N/A | M8 | 14mm spanner |
| **APD-ULP30** | 30 | 90 | 5 | 5 | N/A | M8 | 14mm spanner |
| **APD-ULJ30** | 30 | 90 | 5 | 5 | N/A | M8 | 14mm spanner |
| **APD-ULJ40** | 40 | 120 | 2 | 2 | N/A | M8 | 14mm spanner |
| **APD-ULJ55** | 55 | 165 | 1/0 | 1/0 | N/A | M8 | 14mm spanner |
| **APD-ULP56** | 56 | 168 | 1/0 | 1/0 | N/A | M8 | 14mm spanner |
| **APD-ULJ65** | 65 | 196 | 2/0 | 2/0 | N/A | M8 | 14mm spanner |
| **APD-ULP65** | 65 | 196 | 2/0 | 2/0 | N/A | M8 | 14mm spanner |
| **APD-ULJ80** | 80 | 241 | 3/0 | 3/0 | N/A | M8 | 14mm spanner |
| **APD-ULP82** | 82 | 247 | 3/0 | 3/0 | N/A | M8 | 14mm spanner |
| **APD-ULJ100** | 100 | 301 | 2*2/0 | 2/0 | N/A | M12 | 17mm spanner |
| **APD-ULP100** | 100 | 301 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ125** | 125 | 376 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ150** | 150 | 451 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULP150** | 150 | 451 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULP178** | 178 | 535 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ180** | 180 | 541 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULP200** | 200 | 601 | 3*3/0 | 2*3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ200** | 200 | 601 | 3*3/0 | 2*3/0 | N/A | M12 | 19mm spanner |
| **APD-ULP250** | 250 | 752 | 3*3/0 | 2*3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ250** | 250 | 752 | 3*3/0 | 2*3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ275** | 275 | 827 | 3*3/0 | 2*3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ300** | 300 | 902 | 3*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULP300** | 300 | 902 | 3*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ350** | 350 | 1053 | 4*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULP350** | 350 | 1053 | 4*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ400** | 400 | 1203 | 4*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULP400** | 400 | 1203 | 4*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULP461** | 461 | 1386 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULJ500** | 500 | 1504 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULP512** | 512 | 1540 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **APD-ULP565** | 565 | 1699 | 6*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULP611** | 611 | 1837 | 6*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULM800** | 800 | 2407 | 8*4/0 | 4*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULM1000** | 1000 | 3007 | 6*500Kcmil | 3*500Kcmil | M12 | M12 | 19mm spanner |
| **APD-ULV250** | 250 | 752 | 3*3/0 | 2*3/0 | N/A | M12 | 19mm spanner |
| **APD-ULV300** | 300 | 902 | 3*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULV350** | 350 | 1053 | 4*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULV400** | 400 | 1203 | 4*4/0 | 2*4/0 | N/A | M12 | 19mm spanner |
| **APD-ULV450** | 450 | 1353 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULV500** | 500 | 1504 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULV550** | 550 | 1654 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |
| **APD-ULV600** | 600 | 1804 | 5*4/0 | 3*4/0 | M12 | M12 | 19mm spanner |

| **Genset** | | **Standby load Current at (single 240V (single 120V)** | **Cable section Y V V Single core for each phase** | **N phase wiring harness (AWG)** | **Terminal Size** | **N** | **install tool** |
|---|---|---|---|---|---|---|---|
| **Model** | **StandBy Power (KW)** | **(A)** | **(AWG)** | | | **connection bolt size** | |
| **APD-ULP9** | 9 | 37.5 | 9 | 9 | N/A | N/A | N/A |
| **APD-ULP13** | 13 | 54.2 | 3 | 3 | N/A | N/A | N/A |
| **APD-ULP20** | 20 | 83.3 | 3 | 3 | N/A | M10 | 17mm spanner |
| **APD-ULP28** | 28 | 116.7 | 2 | 2 | N/A | M10 | 17mm spanner |
| **APD-ULP30** | 30 | 125 | 2 | 2 | N/A | M10 | 17mm spanner |
| **APD-ULJ30** | 30 | 125 | 2 | 2 | N/A | M10 | 19mm spanner |
| **APD-ULJ40** | 40 | 167 | 1/0 | 1/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ55** | 55 | 208 | 2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULP56** | 56 | 220.8 | 3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ65** | 65 | 250 | 3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULP65** | 65 | 258.3 | 3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ80** | 80 | 333.3 | 2*1/0 | 1/0 | N/A | M12 | 19mm spanner |
| **APD-ULP82** | 82 | 333.3 | 2*1/0 | 1/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ100** | 100 | 400 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULP100** | 100 | 404.2 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ125** | 125 | 521 | 2*2/0 | 2/0 | N/A | M12 | 19mm spanner |
| **APD-ULJ150** | 150 | 625 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |
| **APD-ULP150** | 150 | 625 | 2*3/0 | 3/0 | N/A | M12 | 19mm spanner |

Table 10.2 Recommended single core cable cross section at 40℃ ambient

The insulation resistance should be in excess of 1 MΩ to earth. Should the insulation resistance be less than 1 MΩ, the windings must be dried out.

# 11. ACOUSTIC SILENCING

Controlling the amount of noise output by a generating set is becoming very important in most installations. There is a variety of components available to control the noise level.

**WARNING**

! Ear protection must be worn when operating or working around an operating generating set.

### 11.1. Exhaust Silencers:

As discussed in Section 3.10 the exhaust silencer will decrease sound level from the engine.

### 11.2. Canopies:

Section 4.2 discusses sound attenuating canopies that lower the noise level of the entire generating set.

### 11.3. Other Sound Attenuation:

For installation in buildings, there are other types of equipment such as acoustic louvers, splitter vents, and fan silencers as well as sound absorbing wall coverings that can be used to reduce the noise levels of generating sets.

# 12. STORAGE

Long-term storage can have detrimental effects on both the engine and alternator. These effects can be minimized by properly preparing and storing the generating set.

### 12.1. Engine Storage:

The engine should be put through an engine “preservation” procedure that includes cleaning the engine and replacing all the fluids with new fluids or preserving fluids.

### 12.2. Alternator Storage:

When an alternator is in storage, moisture tends to condense in the windings. To minimize condensation, store the generating set in a dry storage area. If possible use space heaters to keep the windings dry. After removing the generating set from storage, perform an insulation check as discussed in Section 10.6.

### 12.3. Battery Storage:

While the battery is stored, it should receive a refreshing charge every 8 weeks up to a fully charged condition.

# 13. GENERAL PRECAUTIONS AND CONTROLS WHICH MUST BE DONE BEFORE STARTING UP THE GENERATING SET.

● Make a general visual inspection on the engine and alternator. Check to see if there are any breaks, cracks, indentation, leaks, or looseness. If any of these exist, DO NOT operate the generating set before making the necessary repairs.

● Take out foreign materials such as keys, tools, cleaning wool, papers, etc. on the engine and the alternator.

● Check the fuel level in day tank. Refill with fuel if it is low.

● Check the oil level on the dipstick. Refill with an appropriate oil if it is low. Oil level should normally be close to the maximum level line.

● Look at the water level by opening the radiator tap. If it is inadequate, add more water. Water level should be approximately 1-/8” lower than the water filling neck.

● Engine cooling water must include antifreeze according to the coolest weather conditions in the area.

● A mixture of 50% antifreeze and 50% water provides a good protection in all areas.

● Inspect the radiator air outlet hood, open if clogged, and clear away all obstructions in front of the air outlet.

● Check the air filter gauge. Clean or replace the air filter, if necessary.

● Make sure that opening is not obstructed.

● Make sure that the generating set can easily take air from the environment.

● Check the battery connection cables. Take care to tighten any loose battery terminals with the proper size tool and cover with any battery terminal coating substance. In order to keep clean and avoid oxidation and corrosion of terminals.

● Open the battery caps and check the liquid level in the cells for maintenance type battery. Add distilled water, if necessary, so as to be approximately 3/8”higher than the separation. Never fill the cells with tap water, acid water or acid.

● Ensure that the circuit breaker outlet switch is in the OFF position.

● Make sure that the emergency stop button is not pressed.

# 14. GENERATING SET CONTROL SYSTEMS (DSE 7320 MKII)

To control and monitor the generating set, an electronic control system has been used. The DSE7320 MKII control system is fitted to all generating sets. This control panel provides a means of starting and stopping the generating set, monitoring its operation and output, and automatically shutting down the set in the event of critical condition arising such as low oil pressure or high engine temperature.

### 14.1 DSE7320 MKII, Control System

The DSE7320 MKII is an Auto Start Control Module and an Auto Mains (Utility) Failure Control Module suitable for a wide variety of single, diesel or gas, gen-set applications. Monitoring an extensive number of engine parameters, the modules will display warnings, shutdown and engine status information on the back-lit LCD screen, illuminated LEDs, remote PC and via SMS text alerts (with external modem). The DSE7320 MKII will also monitor the mains (utility) supply. The modules include USB, RS232 and RS485 ports as well as dedicated DSENet® terminals for system expansion
The module is compatible with electronic (CAN) and non-electronic (magnetic pick-up/alternator sensing) engines and offer an extensive number of flexible inputs, outputs and extensive engine protections so the system can be easily adapted to meet the most demanding industry requirements.

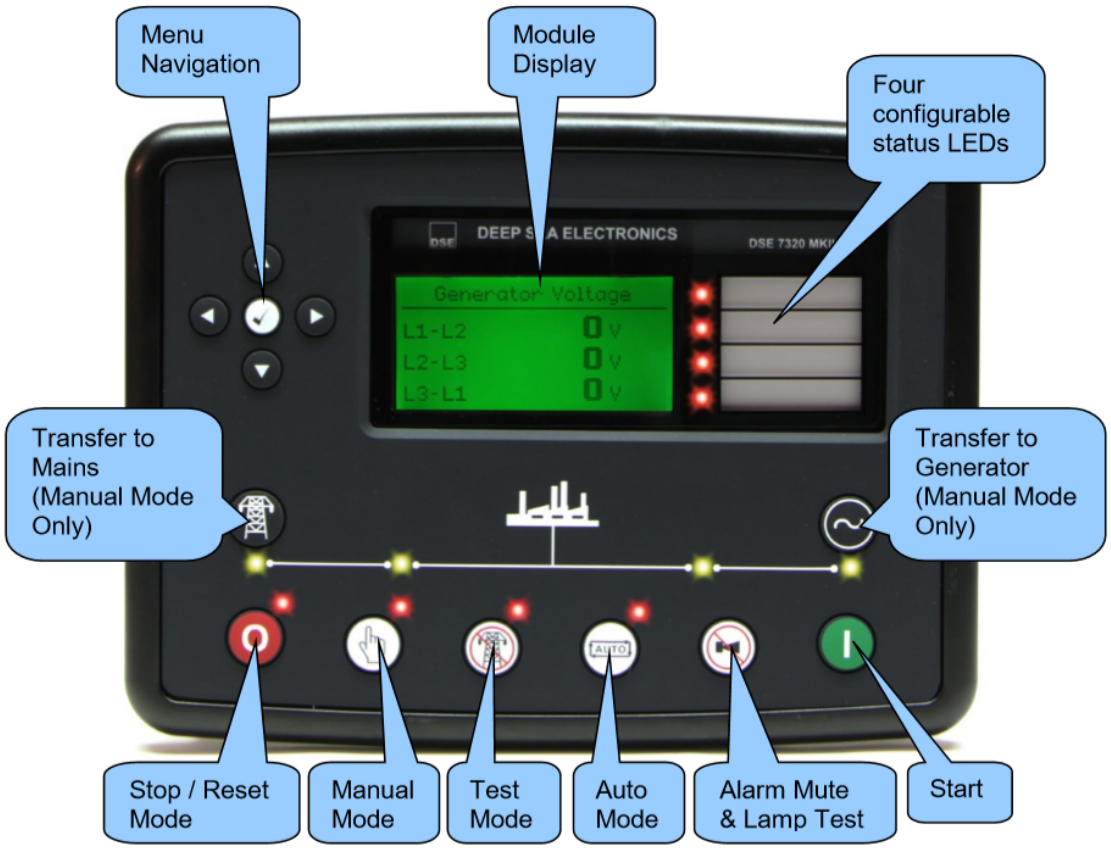
The extensive list of features includes enhanced event and performance monitoring, remote communications & PLC functionality. Dual mutual standby is now available on both the DSE7310 MKII & DSE7320 MKII using RS232 or RS485 communications. This provides for a simpler and more convenient installation with more advanced features such as true engine hours balancing.
The modules can be easily configured using the DSE Configuration Suite PC software. Selected front panel editing is also available.

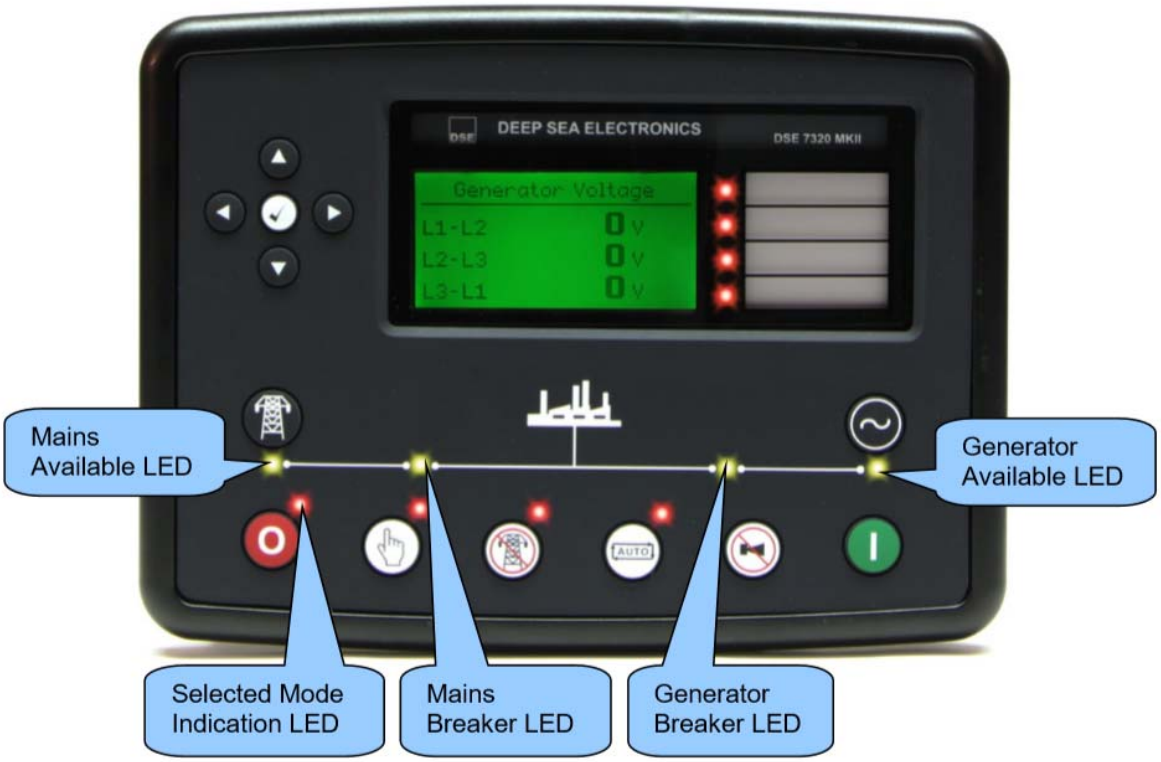
### 14.1.1 Decsription of Controls

**CAUTION: The module may instruct an engine start event due to external influences. Therefore, it is possible for the engine to start at any time without warning. Prior to performing any maintenance on the system, it is recommended that steps are taken to remove the battery and isolate supplies.**

**NOTE: The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.**

Control of the module is via push buttons mounted on the front of the module with ***Stop/Reset Mode***, ***Manual Mode***, ***Test Mode*** (DSE7320 MKII Only), ***Auto Mode*** and ***Start*** functions. For normal operation, these are the only controls which need to be operated. Details of their operation are provided later in this document.






#### 14.1.2 Control Push Button

| Icon | Description |
|---|---|
|  | **Stop / Reset Mode**<br><br>This button places the module into its ***Stop/Reset Mode*** . This clears any alarm conditions for which the triggering criteria has been removed. If the engine is running and the module is put into ***Stop/Reset Mode*** , the module automatically instructs the generator off load *('**Close Generator Output**' becomes inactive (if used on))* and place the mains on load *('**Close Mains Output**' becomes active (DSE7320 MKII))*. The fuel supply de-energises and the engine comes to a standstill. Should any form of *start signal* be present when in ***Stop/Reset Mode*** the generator remains at rest |

| | |
|---|---|
|  | **Manual Mode**<br><br>This button places the module into its ***Manual Mode*** . Once in ***Manual Mode*** , the module responds to the ***Start*** button to start the generator and run it off load.<br><br>To place the generator on load, use the ***Transfer to Generator*** button. The module automatically instructs the changeover device to take the mains off load *('**Close Mains Output**' becomes inactive (if used on DSE7320 MKII))* and place the generator on load *('**Close Generator Output**' becomes active (if used))*. To place the generator off load, use the ***Transfer to Mains*** or ***Open Generator*** buttons. The module automatically instructs the changeover device to take the generator off load *('**Close Generator Output**' becomes inactive (if used on))* and place the mains on load *('**Close Mains Output**' becomes active (DSE7320 MKII))*. Additional digital inputs can be assigned to perform these functions.<br><br>If the engine is running off-load in ***Manual Mode*** and on load signal becomes active, the module automatically instructs the changeover device the changeover device to take the mains off load *('**Close Mains Output**' becomes inactive (if used on DSE7320 MKII))* and place the generator on load *('**Close Generator Output**' becomes active (if used))*. Upon removal of the on load signal, the generator remains on load until either selection of the ***Stop/Reset Mode*** or ***Auto Mode*** . |

| | |
|---|---|
|  | **Test Mode (DSE7320 MKII Only)**<br><br>This button places the module into its ***Test Mode*** . Once in ***Test Mode*** , the module responds to the ***Start*** button to start the generator.<br><br>Once the set has started and becomes available, it is automatically placed on load (Close Mains Output becomes inactive (if used on DSE7320 MKII) and Close Generator Output becomes active (if used)).<br><br>The generator remains on load until either the ***Stop/Reset Mode*** or ***Auto Mode*** is selected. |

| Icon | Description |
|---|---|
|  | **Auto Mode**<br><br>This button places the module into its ***Auto Mode*** . This mode allows the module to control the function of the generator automatically. The module monitors numerous start requests and when one has been made, the set is automatically started. Once the generator is available, the mains is taken off load *('**Close Mains Output**' becomes inactive (if used on DSE7320 MKII))* and the generator is placed on load *('**Close Generator Output**' becomes active (if used))*.<br><br>Upon removal of the starting signal, the module starts the *Return Delay Timer* and once expired, takes the generator off load *('**Close Generator Output**' becomes inactive (if used on))* and place the mains on load *('**Close Mains Output**' becomes active (DSE7320 MKII))*. The generator then continues to run for the duration of the *Cooling Timer* until it stops. The module then waits for the next start event. |

| | |
|---|---|
|  | **Alarm Mute / Lamp Test**<br><br>This button silences the audible alarm in the controller, de-activates the *Audible Alarm* output (if configured) and illuminates all of the LEDs on the module's facia as a lamp test function. |

| | |
|---|---|
|  | **Start**<br><br>This button is only active in the ***Stop/Reset Mode*** , ***Manual Mode*** and Test Mode .<br><br>Pressing the ***Start*** button in ***Stop/Reset Mode*** powers up the engine's ECU but does not start the engine. This can be used to check the status of the CAN communication and to prime the fuel system.<br><br>Pressing the ***Start*** button in ***Manual Mode*** or ***Test Mode*** starts the generator and runs it off load in ***Manual Mode*** or on load in ***Test Mode*** . |

| | |
|---|---|
|  | **Menu Navigation**<br><br>Used for navigating the instrumentation, event log and configuration screens. |

| Icon | Description |
|---|---|
|  | **Transfer To Generator**<br><br>The ***Transfer to Generator*** button controls the operation of the generator load switch is only active in the ***Manual Mode*** once the generator is available.<br><br>**'Normal' Breaker Button Control**<br>Pressing the ***Transfer to Generator*** button when the Generator is available and off load, the Mains load switch is opened *('**Close Mains**' becomes inactive)* and the Generator load switch is closed *('**Close Generator**' becomes active)*.<br>Further presses of the ***Transfer to Generator*** button have no effect.<br><br>**'Alternative' Breaker Button Control**<br>Pressing the ***Transfer to Generator*** button when the Generator is available and off load, the Mains load switch is opened *('**Close Mains**' becomes inactive)* and the Generator load switch is closed *('**Close Generator**' becomes active)*.<br>Further presses of the ***Transfer to Generator*** button opens and closes the Generator load switch *('**Close Generator**' changes state)* and leaves the Mains load switch in the open position *('**Close Mains**' remains inactive)*. |

| | |
|---|---|
|  | **Open Generator (DSE7310 MKII Only)**<br><br>The ***Open Generator*** button is only active in the ***Manual Mode*** and allows the operator to open the generator load switch. Pressing the ***Open Generator*** button when the Generator is on load, the generator load switch is opened *('**Close Generator**' becomes inactive)*. Further presses of the ***Open Generator*** button have no effect. |

| | |
|---|---|
|  | **Transfer To Mains (DSE7320 MKII Only)**<br><br>The ***Transfer to Mains*** button controls the operation of the mains load switch and is only active in ***Manual Mode***.<br><br>**'Normal' Breaker Button Control**<br>Pressing the ***Transfer to Mains*** button when the Mains is available and off load, the generator switch is opened *('**Close Generator**' becomes inactive)* and the mains switch is closed *('**Close Mains**' becomes active)*. Further presses of the ***Transfer to Mains*** button have no effect.<br><br>**'Alternative' Breaker Button Control**<br>Pressing the ***Transfer to Mains*** button when the Mains is available and off load, the generator load switch is opened *('**Close Generator**' becomes inactive)* and the mains load switch is closed *('**Close Mains**' becomes active)*. Further presses of the ***Transfer to Mains*** button opens and closes the mains load switch *('**Close Mains**' changes state)* and leaves the generator load switch in the open position *('**Close Generator**' remains inactive)*. |

### 14.1.3 Viewing Instrument Pages

It is possible to scroll to display the different pages of information by repeatedly operating the ***Next & Previous Page*** buttons.

Example

If you want to view one of the instrument pages towards the end of the list, it may be quicker to scroll left through the pages rather than right!

**Status** **Generator** **Mains**

And so on until the desired page is reached. Further presses of the ***Next Page Button*** returns the Status page.

The complete order and contents of each information page are given in the following sections

Once selected, the page remains on the LCD display until the user selects a different page, or after an extended period of inactivity (*LCD Page Timer*), the module reverts to the status display.

If no buttons are pressed upon entering an instrumentation page, the instruments displayed are automatically subject to the setting of the *LCD Scroll Timer*.

The *LCD Page* and *LCD Scroll* timers are configurable using the DSE Configuration Suite Software or by using the Front Panel Editor.

Alternatively, to scroll manually through all instruments on the currently selected page, press the ***Instrumentation Scroll***  buttons. The 'auto scroll' is disabled.

To re-enable 'auto scroll' press the ***Instrumentation Scroll***  buttons to scroll to the 'title' of the instrumentation page (ie Mains). A short time later (the duration of the *LCD Scroll Timer*), the instrumentation display begins to auto scroll.

When scrolling manually, the display automatically returns to the Status page if no buttons are pressed for the duration of the configurable *LCD Page Timer*.

If an alarm becomes active while viewing the status page, the display shows the Alarms page to draw the operator's attention to the alarm condition.

# 15. GENERAL PRECAUTIONS AND CONTROLS WHICH MUST BE DONE AFTER STARTING UP THE GENERATING SET

● Check for any abnormal noise or vibration on the generating set.

● Check to see if the exhaust system has any leakage.

● Monitor the generating set operation by means of the control module LCD display. Check the engine temperature and oil pressure Oil pressure must reach the normal value 10 seconds after the generating set begins operation.

● Monitor the generating set outlet voltage and frequency by means of the control module LCD display. Check the voltage to ensure that the phase-to-phase voltage is 480V and the phase to neutral voltage is 277V Check that the frequency is –62 - 64Hz on generating sets with mechanical governors and 60Hz on generating sets with electronic governors.

● If an engine block water heater is not available, run the generating set at no-load for 8 minutes and when the engine is at normal operating temperature, apply the load. For manual models, apply load to the generating set as follows:

● Set the alternator outlet circuit breaker on the panel to the ON position.

● Set the load circuit breakers (or fuses) on the distribution panel to ON position one by one. By performing this step, the generating set cannot be suddenly put under full load. The engine may stall or the alternator winding insulation burning can occur.

● Set the alternator outlet circuit breaker on the circuit to OFF position before stopping the generating set.

● Continue to run the unloaded engine for purpose of cooling period for 5 minutes before shutting genset down.

● Never operate the generating set before removing faults if any are present.

# 16. CONTROL PANELS

Control, supervision and protection panels are mounted on the generator base frame.

These are many fuses inside of the control panel for protection. If a fuse blows, check all related wires. After the problem is resolved, replace the fuse with the appropriate size fuse. DO NOT use a fuse of size other than what was originally in the control panel.

### 16.1. . Control System DSE7320 MKII

**Equipment:**

DSE 7320 MKII, Automatic Mains Failure module

- Static battery charger
- Emergency stop push

button DSE 7320 MKII Module

Features

- To monitor AC main supply
- Automatically controls generating set start and stop
- Provides a signal to the Automatic transfer Switch

(ATS)

- Scrolling digital LCD display
- Remote communication via RS232 port or RS 485 mod bus output.
- Event logging of shutdown alarms.
- Front panel configuration of timers and alarm trip points
- Easy push button control
- STOP/RESET – MANUAL – AUTO – TEST – START

**Metering Via LCD Display**

- Generator Volts (L-L / L - N)
- Generator Ampere (L1, L2, L3)
- Generator Frequency (Hz)
- Generator kVA
- Generator kW
- Generator Cos
- Mains Volt (L - L / L - N)
- Mains Frequency (Hz)
- Engine cooling temperature (°C &°F)
- Engine oil pressure (PSI & Bar)
- Engine speed (RPM)
- Engine hours run
- Plant battery volt

**Multiple Alarms**

- Under / Over generator volts; Pre-alarm and Shutdown
- Under / Over generator frequency Pre-alarm and Shutdown
- Under / Over mains volts
- Under / Over mains frequency
- Over current; Shutdown
- Low oil pressure; Pre-alarm and Shutdown
- High engine temperature; Pre-alarm and Shutdown
- Under/over speed; Shutdown
- Low coolant level; Shutdown
- Fail to start; Shutdown
- Fail to stop; Warning
- Low/High battery volts; Warning
- Charge fail; Warning
- Emergency stop; Shutdown
- Can Data Fail; Shutdown
- Can ECU Fail; Pre-Alar m and Shutdown

**The Event Log**

7320 MKII control module maintains a log the last 15 shutdown alarms to enable the operator or engineer to view the past alarms history.

# 17. THE PLACEMENT AND INTALLATION OF AUTOMATIC TRANSFER SWITCH (ATS)

The placement of the transfer switch and its mountings:

● Position the transfer switch near the emergency power panel.

● Locate the transfer switch in a place where it is clean, not over- heated, and good ventilation is present. If the environment temperature is above 104 $^{o}$F, breakers will open more easily. There must be enough work space around the transfer switch.

● A breaker may be installed between the generating set and the transfer switch, but it is not required. Current from the generating set must be distributed as equally to the three phases as possible.

● Current from one phase should not exceed the nominal current.

● If the transfer switch panel is apart from the generating set, the ATS must be placed as close as possible to the distributor panel.

● In this case, power cables are drawn from the generating set, the main panel, and emergency power panel. Furthermore, control cables must be drawn from the generating set control panel.

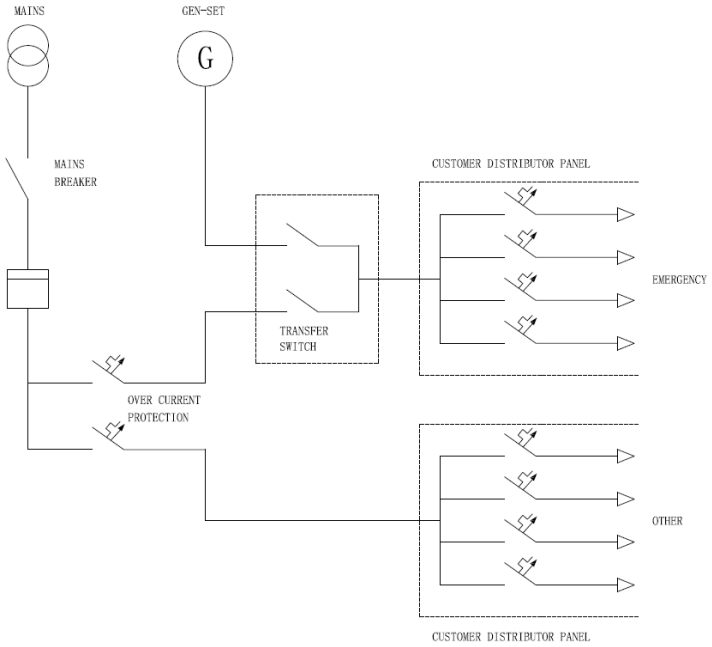



Figure 17.1 Typical emergency power system installation

# 18. . ENGINE TROUBLESHOOTING

**The starter motor turns the engine too slowly:**

● Battery capacity to low

● Bad electrical connection

● Faulty in starter motor

● Wrong grade of lubricating oil

**The engine does not start or difficult to start:**

● Starter motor turns engine too slowly

● Fuel tank empty

● Faulty in fuel control solenoid

● Restriction in a fuel pipe

● Faulty in fuel lift pump

● Dirty fuel filter element

● Air in fuel system

● Faulty in atomizers

● Colt start systems used incorrectly

● Fault in cold start system

● Restriction in fuel tank vent

● Wrong type or grade of fuel used

● Restriction in exhaust pipe

**Not enough power:**

● Restriction in a fuel pipe

● Faulty in fuel lift pump

● Dirty fuel filter element

● Air in fuel system

● Restriction air filter/cleaner or induction system

● Restriction in exhaust pipe

● Fault in atomizers or atomizers of an incorrect type

● Restriction in fuel tank vent

● Wrong type or grade of fuel used

● Restricted movement of engine speed control

● Engine temperature is too high or low

**Misfire**

● Restriction in a fuel pipe

● Faulty in fuel lift pump

● Dirty fuel filter element

● Air in fuel system

● Fault in atomizers or atomizers of an incorrect type

● Fault in cold start system

● Engine temperature is too high

● Incorrect valve tip clearances

**The pressure of the lubrication oil is too low:**

● Wrong grade of lubrication

● Not enough lubrication oil in sump

● Defective gauge

● Dirty lubrication oil filter element

**High fuel consumption:**

● Restriction air filter/cleaner or induction system

● Fault in atomizers or atomizers of an incorrect type

● Fault in cold start system

● Wrong type or grade of fuel used

● Restricted movement of engine speed control

● Restriction in exhaust pipe

● Engine temperature is too low

● Incorrect valve tip clearances

**Black exhaust smoke:**

● Restriction air filter/ cleaner or induction system

● Fault in atomizers or atomizers of an incorrect type

● Fault in cold start system

● Wrong type or grade of fuel used

● Restriction in exhaust pipe

● Engine temperature is too low

● In correct valve tip clearances

● Engine over load

**Blue or white exhaust smoke**

● Wrong grade of lubrication

● Fault in cold start system

● Engine temperature is too low

**The engine knocks:**

● Faulty in fuel lift pump

● Fault in atomizers or atomizers of an incorrect type

● Wrong type or grade of fuel used

● Fault in cold start system

● Engine temperature is too high

● Incorrect valve tip clearances

**The engine runs erratically:**

- Fault in fuel control
- Restriction in a fuel system
- Fault in fuel lift pump
- Dirty fuel filter element
- Restriction air filter/cleaner or induction system
- Air in fuel system
- Fault in atomizers or atomizers of an incorrect type
- Fault in cold start system
- Restriction in fuel tank vent
- Restricted movement of engine speed control
- Engine temperature is too high
- In correct valve tip clearances

**Vibration:**

- Fault in atomizers or atomizers of an incorrect type
- Restricted movement of engine speed control
- Engine temperature is too high
- Fan damaged
- Fault in engine mounting or flywheel housing
- The engine temperature is too high:
- Restriction air filter/cleaner or induction system
- Fault in atomizers or atomizers of an incorrect type
- Fault in cold start system
- Restriction in exhaust pipe
- Fan damaged
- Too much lubrication oil in pump
- Restriction in air or water passage of radiator
- Insufficient coolant system

**Crankcase pressure:**

- Restriction in breather pipe
- Vacuum pipe leaks or fault in exhauster

**Bad compression:**

- Restriction air filter/cleaner or induction system
- Incorrect valve tip clearances

**The engine starts and stops:**

- Dirty fuel filter element
- Restriction air filter/cleaner or induction system
- Air in fuel system

**The engine shuts down after approximately 15 seconds:**

# 19. GENERAL PRECAUTIONS ABOUT WARRANTY

DEAR AKSA GENERATING SET OPERATOR,

PLEASE TAKE CARE TO THE FOLLOWING IN ORDER TO PREVENT THE GENERATING SET WARRANTY FROM BECOMING INVALID PRIOR TO THE TERMINATION OF THE WARRANTY PERIOD AND TO ENSURE TROUBLE-FREE OPERATION OF THE GENERATING SET.

MAINTENANCE AND REPAIR WORKS WILL NOT BE COVERED BY THE WARRANTY UNLESS THE WARRANTY CERTIFICATE, INVOICE, OR DELIVERY CERTIFICATE OF THE GENERATING SET IS SUBMITTED.

THE WARRANTY OF THE GENERATING SET WILL BECOME INVALID IN THE CASE OF ANY INTERVENTION OF ANY PERSON OTHER THAN AUTHORIZED AKSA SERVICES OR BY PRIOR WRITTEN APPROVAL FROM AKSA POWER GENERATION ON THE GENERATING SET FOR ANY REASON.

CONTROL AND MAINTENANCE WORK INDICATED IN THE PERIODICAL MAINTENANCE SCHEDULE AND THE OPERATING MANUAL MUST BE CARRIED OUT COMPLETELY AND TIMELY. THE FAILURES DUE TO INCOMPLETE OR UNTIMELY MAINTENANCE ARE NOT COVERED BY THE WARRANTY.

GENERATING SET SHOULD BE MOUNTED AS INDICATED IN THE OPERATING MANUAL OTHERWISE; THE PROBLEMS WHICH ARE LIKELY TO OCCUR WILL NOT BE COVERED BY THE WARRANTY. THE CUSTOMER IS RESPONSIBLE FOR THE FAILURES WHICH ARE LIKELY TO OCCUR IN THE CASE THAT THE DIESEL OIL USED CONTAINS DIRT OR WATER.

THE OIL TYPE INDICATED IN THE OPERATING MANUAL SHOULD BE USED IN THE ENGINE. OTHERWISE, THE FAILURES WHICH ARE LIKELY TO OCCUR WILL NOT BE COVERED BY THE WARRANTY.

BATTERIES WILL NOT BE COVERED BY THE WARRANTY IF THEY ARE SUBJECTED TO BREAKAGE, EXCESSIVE ACID FILL, OR HARDENING BY LEAVING UNCHARGED.

ON MANUAL GENERATING SETS, NEVER START OR STOP THE DIESEL ENGINE WHEN THE GENERATING SET IS UNDER LOAD. ENGINE SHOULD BE STARTED AND STOPPED AFTER LOAD IS DISCONNECTED AND THE GENERATING SET IS AT IDLE CONDITION. OTHERWISE, THE VALVES CAN BE SEIZED, THE VOTAGE REGULATOR. TRANSFORMER AND DIODES CAN BE BROKEN. THESE CONDITIONS ARE NOT COVERED BY THE WARRANTY.

OUR COMPANY DOES NOT TAKE THE RESPONSIBILITY OF THE DAMAGES ON THE MAINS SUPPLY CONTACTOR OF THE AUTOMATIC GENERATING SETS DUE TO OVERCURRENT, LOW, OR HIGH VOLTAGE.

NEVER REMOVE THE BATTERY TERMINALS WHILE THE GENERATING SET IS IN USE. EVEN A MOMENT OF DISCONNECTION CAN CAUSE DAMAGE ON THE ELECTRONIC CLOSING RELAY OF THE CHARGE ALTERNATOR AND ON THE ELECTRONIC ENGINE SPEED CONTROL CIRCUIT THESE CONDITIONS ARE NOT COVERED BY THE WARRANTY.

FAILURES DUE TO OVERLOAD AND UNBALANCED LOAD IN EXCESS OF THE GENERATING SET POWER (SUCH AS ALTERNATOR AND CONTACTOR FAILURES) ARE NOT COVERED BY THE WARRANTY.

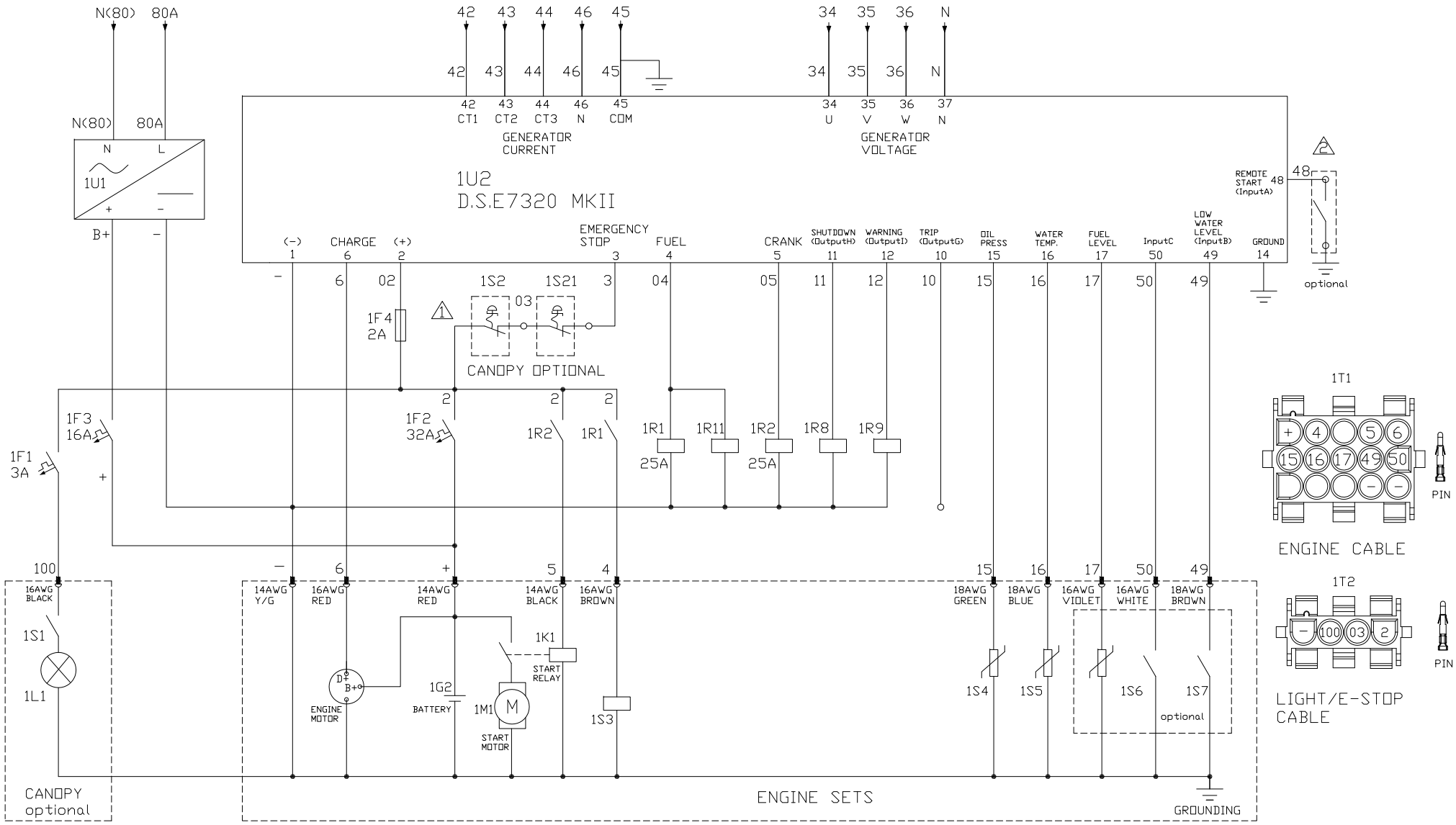
FAILURES DUE TO OVERLOAD AND UNBALANCED LOAD IN EXCESS OF THE GENERATING SET POWER (SUCH AS ALTERNATOR AND CONTACTOR FAILURES) ARE NOT COVERED BY THE WARRANTY.

WHEN THE MANUAL GENERATING SET IS STARTED UP, IT SHOULD BE WARMED BY OPERATING AT IDLE FOR 5 MINUTES. VVHEN STOPPING THE DIESEL ENGINE, IT SHOULD BE UNLOADED AND THEN CONTINUED TO BE OPERATED FOR COOLING FOR 10 MINUTES BEFORE STOPPING.

**The below drawings are for reference only, subject to the drawings shipped with the generator set.**

# 19. ELECTRICAL WRING DIAGRAMS

# APD-ULJ30 - 40 - 55 - 65






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | Change water heater power /add running signal | 2018.01.08 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | Change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

MATERIAL: | QUANTITY: | WEIGHT:

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.08 | HELEN | |
| CONTROLED BY | 01.08 | TOM | |
| APPROVED BY | 01.08 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

PART NAME: START PANEL

USED FOR: APD-ULJ30/40/55/65 (JOHN DEERE 3029/4045TF/4045HF280 DSE7320MKII)

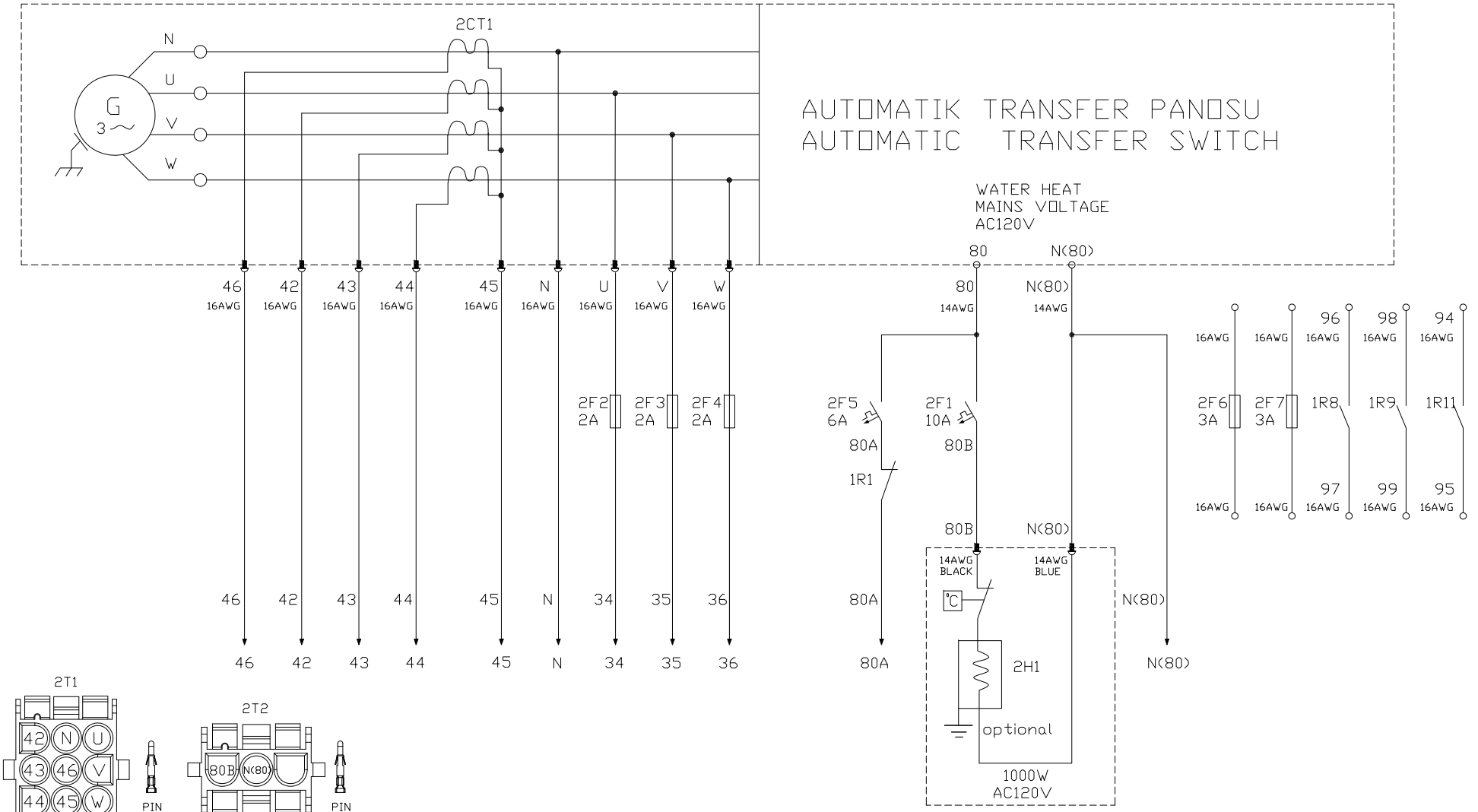
PART NO.: | LOCATION: | A4

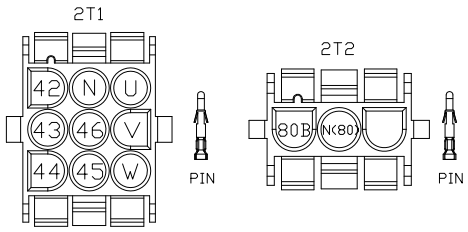
DRAWING NO.: SP.J2362080UL | PAGE 1-3

REVISION NO.: 04

# AUTOMATIK TRANSFER PANOSU
# AUTOMATIC TRANSFER SWITCH

WATER HEAT
MAINS VOLTAGE
AC120V




CT CABLE

HEATER CABLE



| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | Change water heater power /add running signal | 2018.01.08 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | Change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.08 | HELEN | |
| CONTROLED BY | 01.08 | TOM | |
| APPROVED BY | 01.08 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

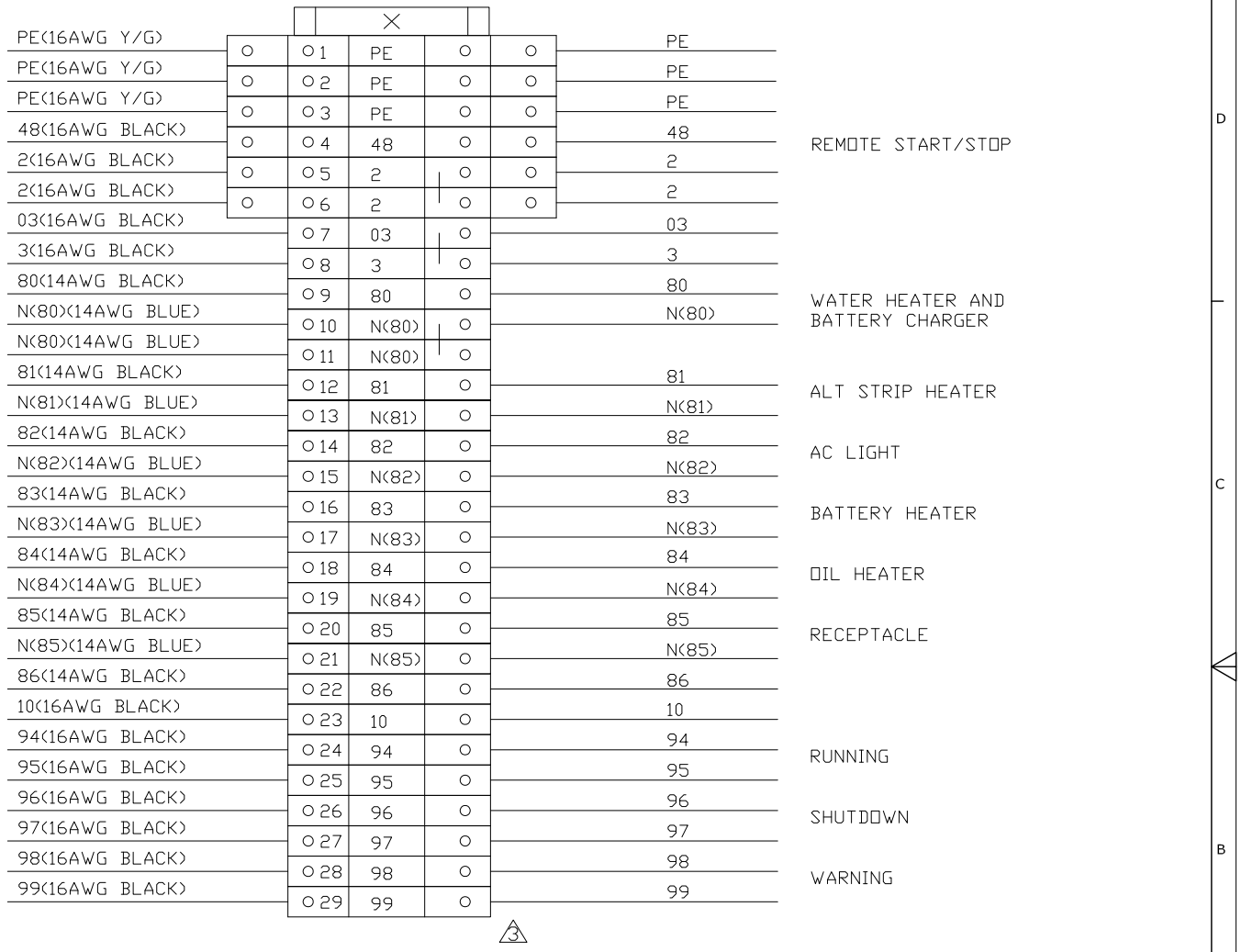
PART NAME: START PANEL

USED FOR: APD-ULJ30/40/55/65
(JOHN DEERE 3029/4045TF/4045HF280 DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362080UL | PAGE 2-3

REVISION NO.: 04






| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 25 | 2H1 | WATER HEATER UL | |
| 24 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEEC57.13) |
| 23 | 2T2 | TYCO 3HOLE 1-480701-0 | UL 1977 |
| 22 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 21 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 20 | 1T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 19 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 18 | 2F5 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 17 | 2F1 | ABB S201U K10A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 16 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 1F2 | ABB S201U K32A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F1 | ABB S201U K3A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 12 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 11 | 1U1 | BATTERY CHARGE AC230V/DC12V | UL 1236 |
| 10 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 09 | 1S7 | LOW WATER LEVEL SWITCH | |
| 08 | 1S6 | FEXIBLE SENSOR | |
| 07 | 1S5 | WATER TEMPERATURE SENSOR | |
| 06 | 1S4 | OIL PRESSURE SENSOR | |
| 05 | 1S3 | FUEL SOLENOID | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z12/SCHEIDER 389FXBXC1-12D DC12V 25A | UL 508 |
| 01 | 1R8,1R9,1R11 | DRM270012LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059).

| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | Change water heater power /add running signal | 2018.01.08 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | Change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.08 | HELEN | |
| CONTROLED BY | 01.08 | TOM | |
| APPROVED BY | 01.08 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

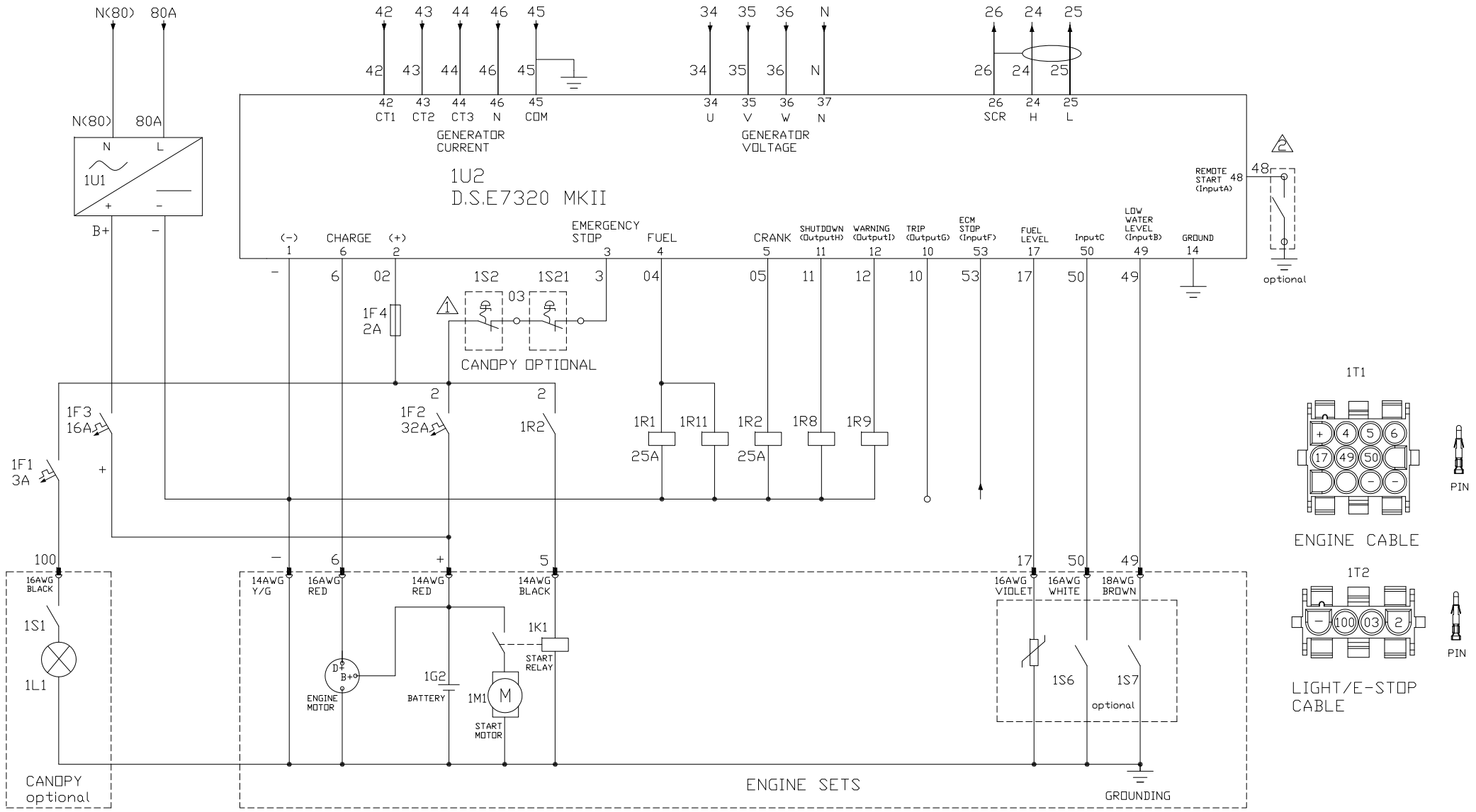
USED FOR: APD-ULJ30/40/55/65 (JOHN DEERE 3029/4045TF/4045HF280 DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362080UL | PAGE 3-3

REVISION NO.: 04

# APD-ULJ80 - 125






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: | WEIGHT: |
|---|---|---|---|---|

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| DRAWINGED BY | 01.24 | HELEN | |
| CONTROLED BY | 01.24 | TOM | |
| APPROVED BY | 01.24 | SAMER | |

DEPARTMENT: ENGINEERING

PART NAME: START PANEL

USED FOR: APD-ULJ80/100/125(JOHN DEERE 4045HF DSE7320MKII)

PART NO.:

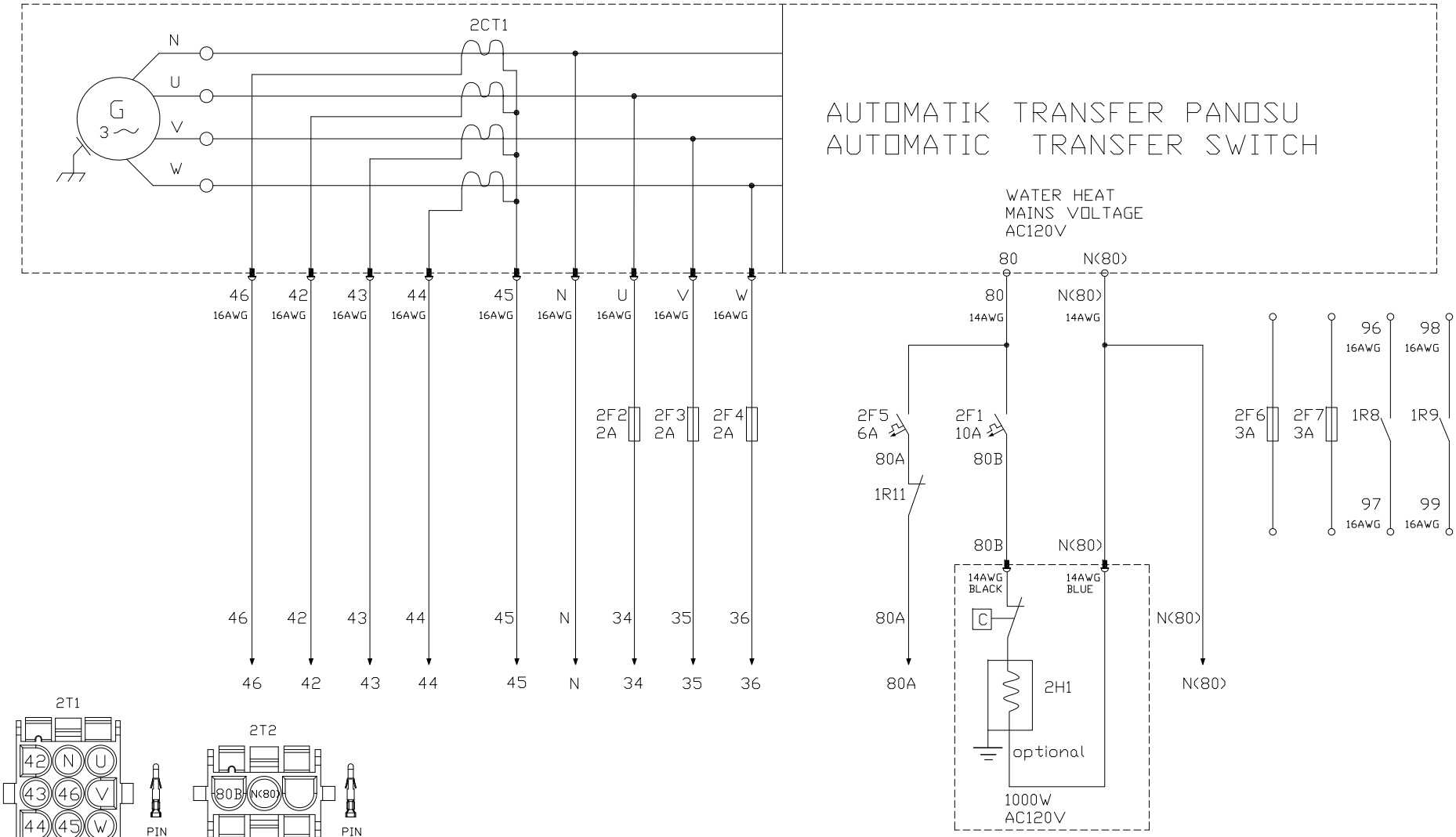
LOCATION:

A4

PAGE 1-4

DRAWING NO.: SP.J2362081UL

REVISION NO.: 04




CT CABLE

HEATER CABLE



| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.24 | HELEN | |
| CONTROLED BY | 01.24 | TOM | |
| APPROVED BY | 01.24 | SAMER | |

DEPARTMENT: ENGINEERING

MATERIAL: | QUANTITY: | WEIGHT:

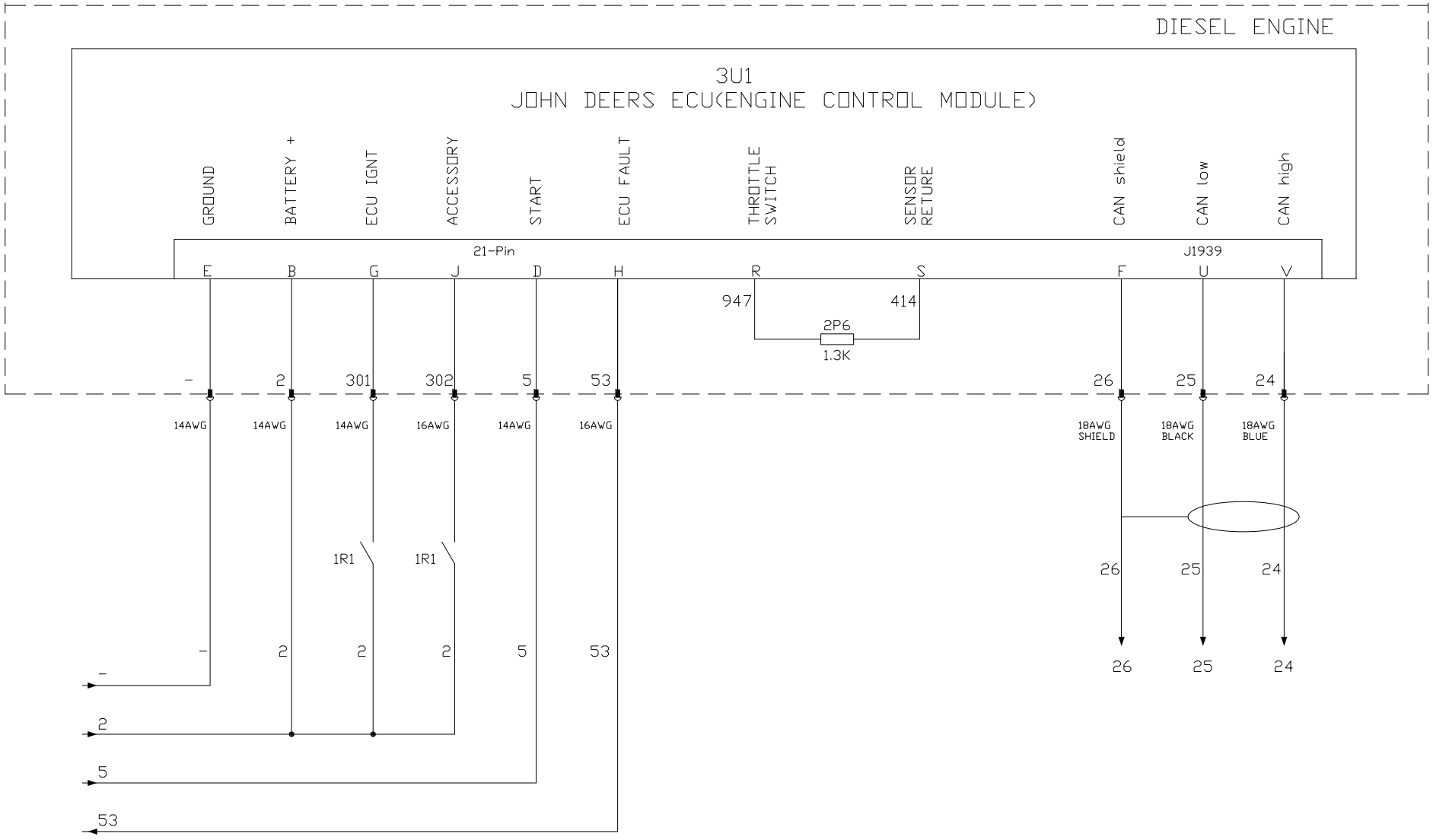
PART NAME: START PANEL

USED FOR: APD-ULJ80/100/125(JOHN DEERE 4045HF DSE7320MKII)

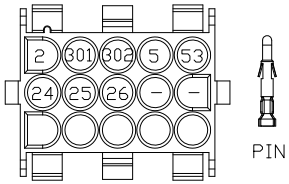
PART NO.: | LOCATION: | A4 | PAGE 2-4

DRAWING NO.: SP.J2362081UL

REVISION NO.: 04




3T1




PIN

ENGINE ECM CABLE



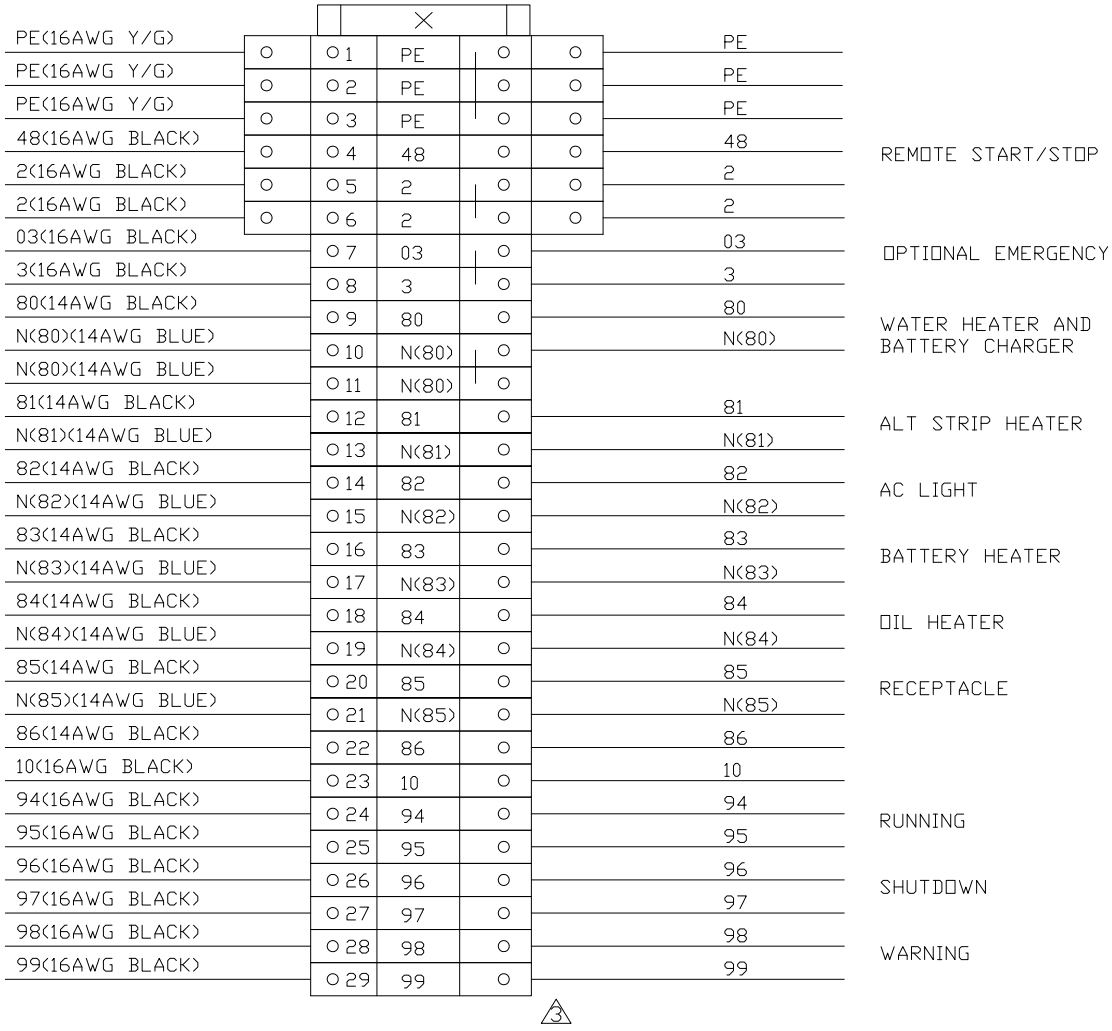
| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

| | | | |
|---|---|---|---|
| ORDER CODE: | | SCALE: | 1:1 |
| | 2018 | DATE | NAME / SIGNITURE |
| | DRAWINGED BY | 01.24 | HELEN |
| | CONTROLED BY | 01.24 | TOM |
| | APPROVED BY | 01.24 | SAMER |
| | DEPARTMENT: | ENGINEERING | |

aksa POWER GENERATION

| | | | |
|---|---|---|---|
| MATERIAL: | QUANTITY: | WEIGHT: | |
| PART NAME: | START PANEL | | |
| USED FOR: | APD-ULJ80/100/125(JOHN DEERE 4045HF DSE7320MKII) | | |
| PART NO.: | | LOCATION: | A4 |
| DRAWING NO.: | SP.J2362081UL | | PAGE 3-4 |
| REVISION NO.: 04 | | | |

| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 24 | 2H1 | WATER HEATER UL | |
| 23 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEE C57.13) |
| 22 | 3T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 21 | 2T2 | TYCO 3HOLE 1-480701-0 | UL 1977 |
| 20 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 19 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 18 | 1T1 | TYCO 12HOLE 1-480709-0 | UL 1977 |
| 17 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 16 | 2F5 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 2F1 | ABB S201UP K10A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 1F2 | ABB S201U K32A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 1F1 | ABB S201U K3A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 11 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 10 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 09 | 1U1 | BATTERY CHARGE AC230V/DC12V | UL 1236 |
| 08 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 07 | 1S7 | LOW WATER LEVEL SWITCH | |
| 06 | 1S6 | FEXIBLE SENSOR | |
| 05 | 1S3 | FUEL SOLENOID | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z12/SCHEIDER 389FXBXC1-12D DC12V 25A | UL 508 |
| 01 | 1R11,1R8,1R9 | DRM270012LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |




1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059).

| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.24 | HELEN | |
| CONTROLED BY | 01.24 | TOM | |
| APPROVED BY | 01.24 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

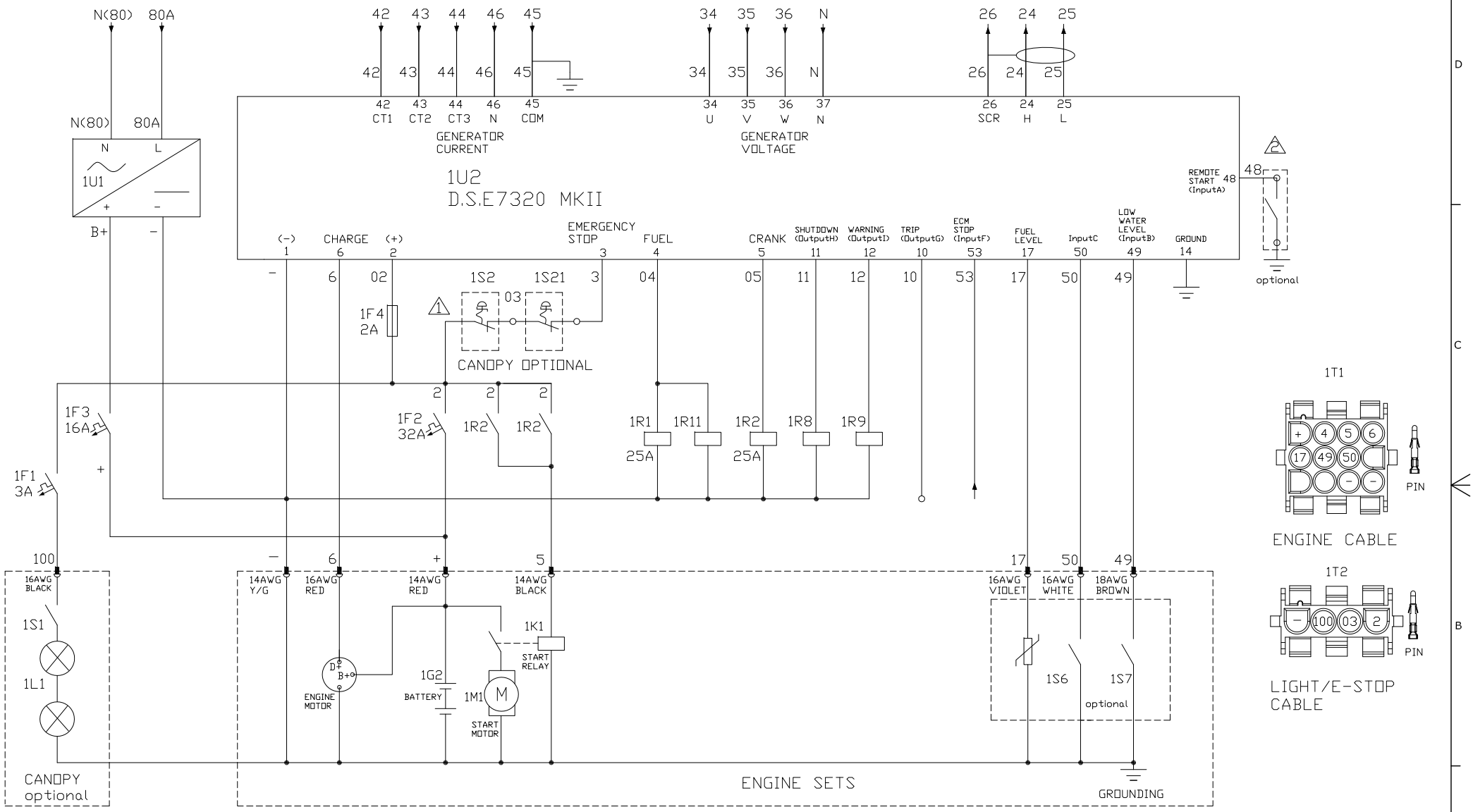
USED FOR: APD-ULJ80/100/125(JOHN DEERE 4045HF DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362081UL | PAGE 4-4

REVISION NO.: 04

# APD-ULJ150 – 275



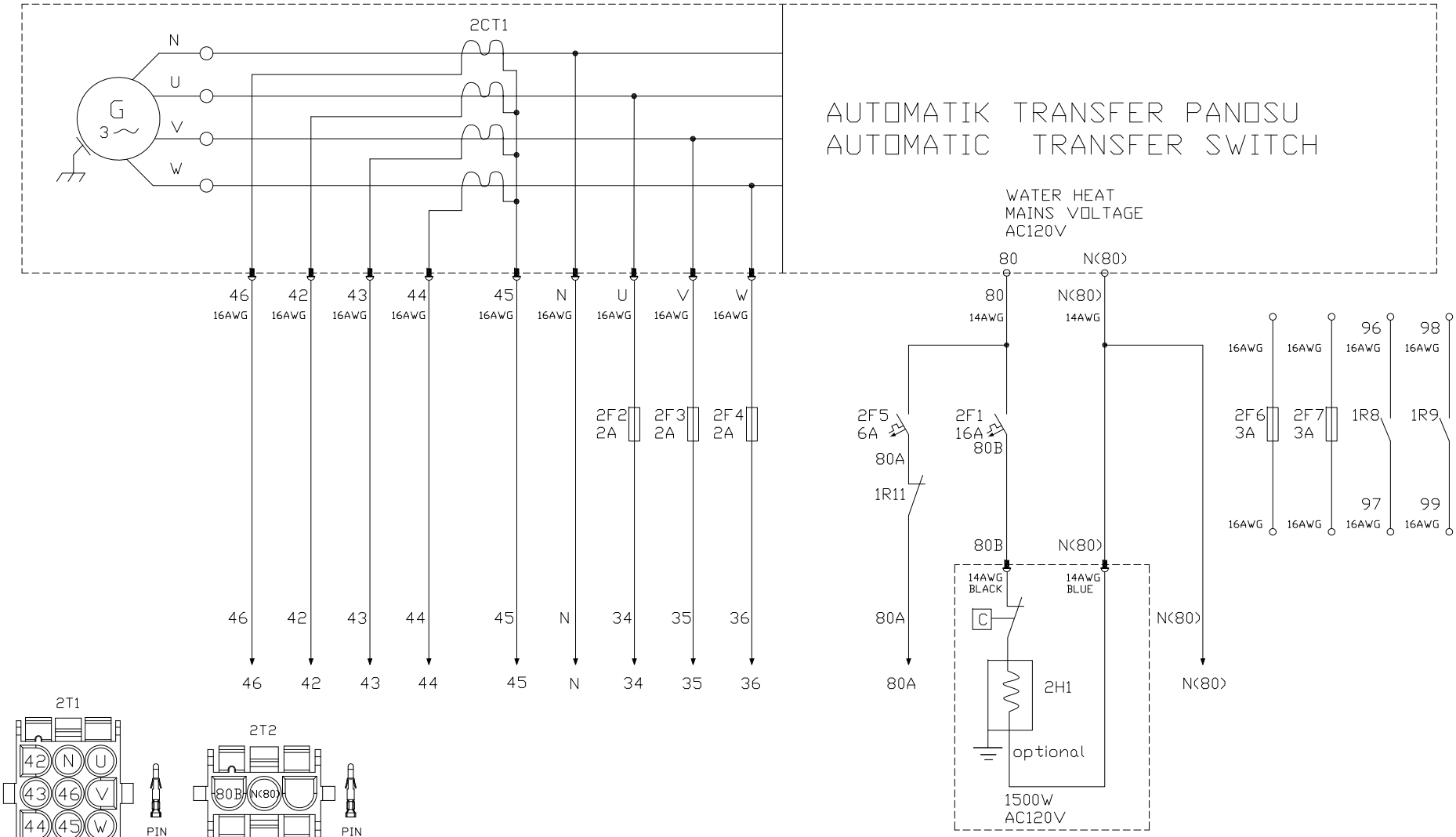



| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

| | | | |
|---|---|---|---|
| ORDER CODE: | | SCALE: | 1:1 |
| | | 2018 | DATE / NAME / SIGNITURE |
| | | DRAWINGED BY | 01.24 HELEN |
| | | CONTROLED BY | 01.24 TOM |
| | | APPROVED BY | 01.24 SAMER |
| | | DEPARTMENT: | ENGINEERING |

| | | | |
|---|---|---|---|
| MATERIAL: | QUANTITY: | WEIGHT: | |
| PART NAME: | START PANEL | | |
| USED FOR: | APD-ULJ250/275 (JOHN DEERE 6090HF DC24V DSE7320MKII) | | |
| PART NO.: | | LOCATION: | A4 |
| DRAWING NO.: | SP.J2362082UL | | PAGE 1-4 |
| REVISION NO.: 04 | | | |

aksa POWER GENERATION






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.24 | HELEN | |
| CONTROLED BY | 01.24 | TOM | |
| APPROVED BY | 01.24 | SAMER | |

DEPARTMENT: ENGINEERING

MATERIAL: | QUANTITY: | WEIGHT:

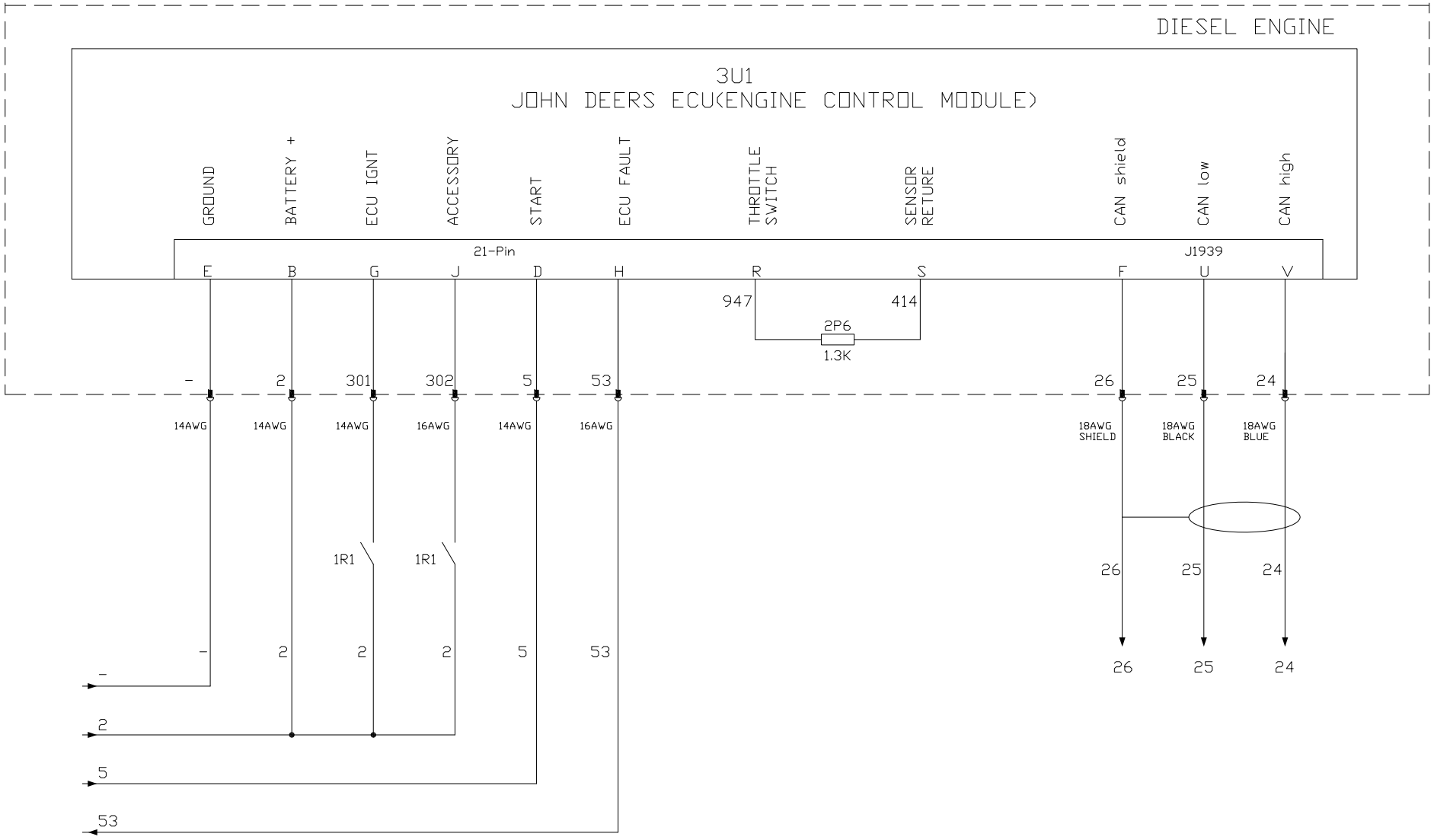
PART NAME: START PANEL

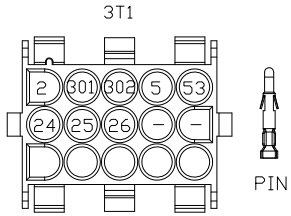
USED FOR: APD-ULJ250/275
(JOHN DEERE 6090HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362082UL | PAGE 2-4

REVISION NO.: 04




PIN

ENGINE ECM CABLE



| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.24 | HELEN | |
| CONTROLED BY | 01.24 | TOM | |
| APPROVED BY | 01.24 | SAMER | |

DEPARTMENT: ENGINEERING

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

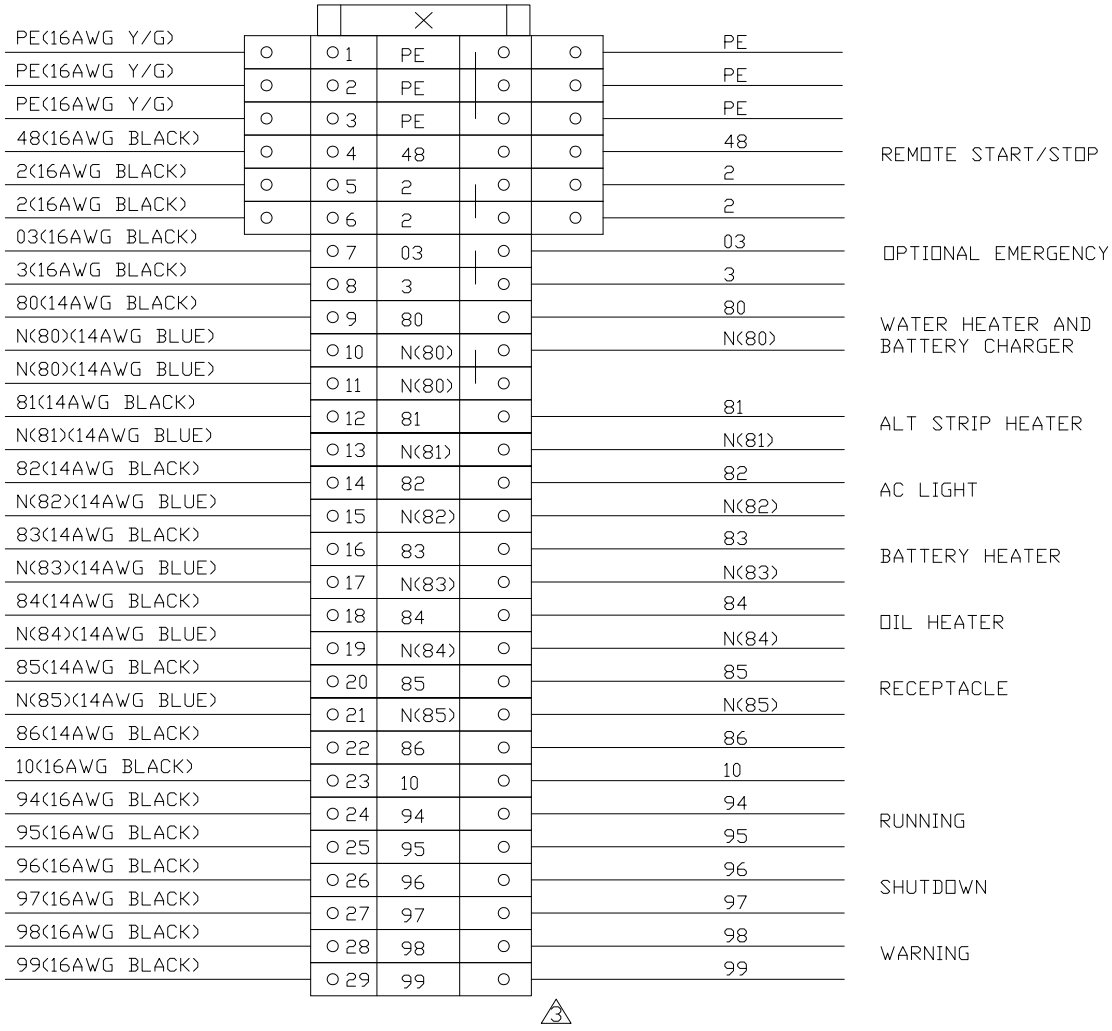
USED FOR: APD-ULJ250/275
(JOHN DEERE 6090HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362082UL | PAGE 3-4

REVISION NO.: 04

| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 24 | 2H1 | WATER HEATER UL | |
| 23 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEE C57.13) |
| 22 | 3T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 21 | 2T2 | TYCO 3HOLE 1-480701-0 | UL 1977 |
| 20 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 19 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 18 | 1T1 | TYCO 12HOLE 1-480709-0 | UL 1977 |
| 17 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 16 | 2F5 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 2F1 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 1F2 | ABB S201U K32A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 1F1 | ABB S201U K3A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 11 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 10 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 09 | 1U1 | BATTERY CHARGE AC230V/DC24V | UL 1236 |
| 08 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 07 | 1S7 | LOW WATER LEVEL SWITCH | |
| 06 | 1S6 | FEXIBLE SENSOR | |
| 05 | 1S3 | FUEL SOLENOID | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z24/SCHEIDER 389FXBXC1-24D DC24V 25A | UL 508 |
| 01 | 1R11,1R8,1R9 | DRM270024LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |




1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059).

| | | | |
|---|---|---|---|
| D | add running signal | 2018.01.24 | HELEN |
| B | Change water heater circuit | 2017.02.06 | Huang |
| A | change DSE7320MKII | 2016.04.14 | CAOKUN |
| SIGN | VARIATION | DATE | NAME |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 01.24 | HELEN | |
| CONTROLED BY | 01.24 | TOM | |
| APPROVED BY | 01.24 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

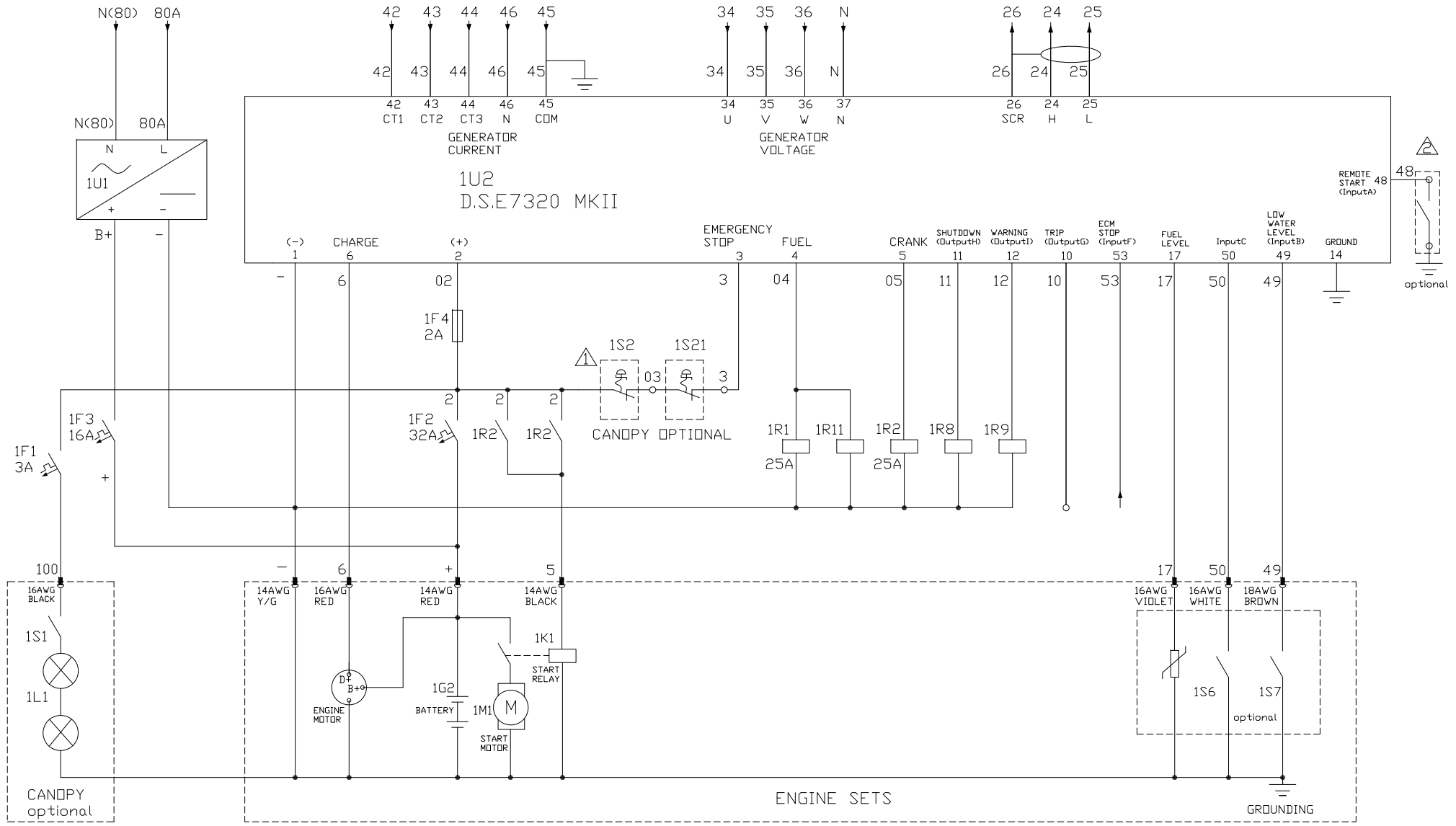
USED FOR: APD-ULJ250/275 (JOHN DEERE 6090HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362082UL | PAGE 4-4

REVISION NO.: 04

# APD-ULJ300 – 500






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| H | add running signal | 2018.02.01 | HELEN |
| G | Change water heater power | 2017.12.13 | LJQ |
| F | Change water heater circuit | 2017.02.07 | Huang |
| E | Change terminal 80B,N(80) to ZDU4 | 2016.12.26 | CAOKUN |
| D | Change terminal heater 80B,N(80) | 2016.12.13 | CAOKUN |
| C | Change PANEL PARTS | 2016.05.10 | CAOKUN |
| B | Change DSE7320 MKII | 2016.04.25 | CAOKUN |
| A | Change start system DC24V | 2016.03.29 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 02.01 | HELEN | |
| CONTROLED BY | 02.01 | TOM | |
| APPROVED BY | 02.01 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

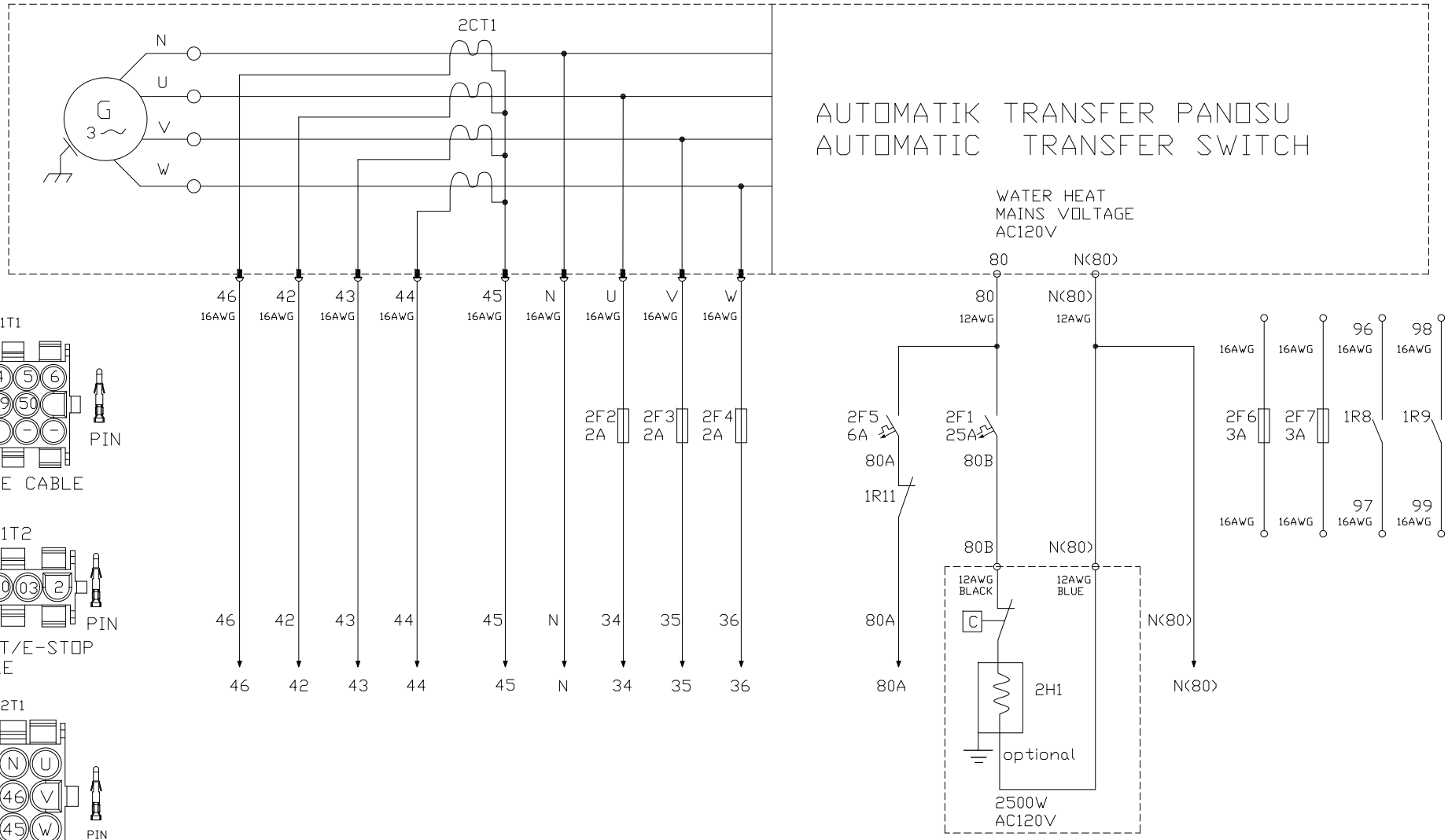
PART NAME: START PANEL

USED FOR: APD-ULJ300/350/400/500
(JOHN DEERE 6090HF/6135HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362086UL | PAGE 1-4

REVISION NO.: 08






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| H | add running signal | 2018.02.01 | HELEN |
| G | Change water heater power | 2017.12.13 | LJQ |
| F | Change water heater circuit | 2017.02.07 | Huang |
| E | Change terminal 80B,N(80) to ZDU4 | 2016.12.26 | CAOKUN |
| D | Change terminal heater 80B,N(80) | 2016.12.13 | CAOKUN |
| C | Change PANEL PARTS | 2016.05.10 | CAOKUN |
| B | Change DSE7320 MKII | 2016.04.25 | CAOKUN |
| A | Change start system DC24V | 2016.03.29 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 02.01 | HELEN | |
| CONTROLED BY | 02.01 | TOM | |
| APPROVED BY | 02.01 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

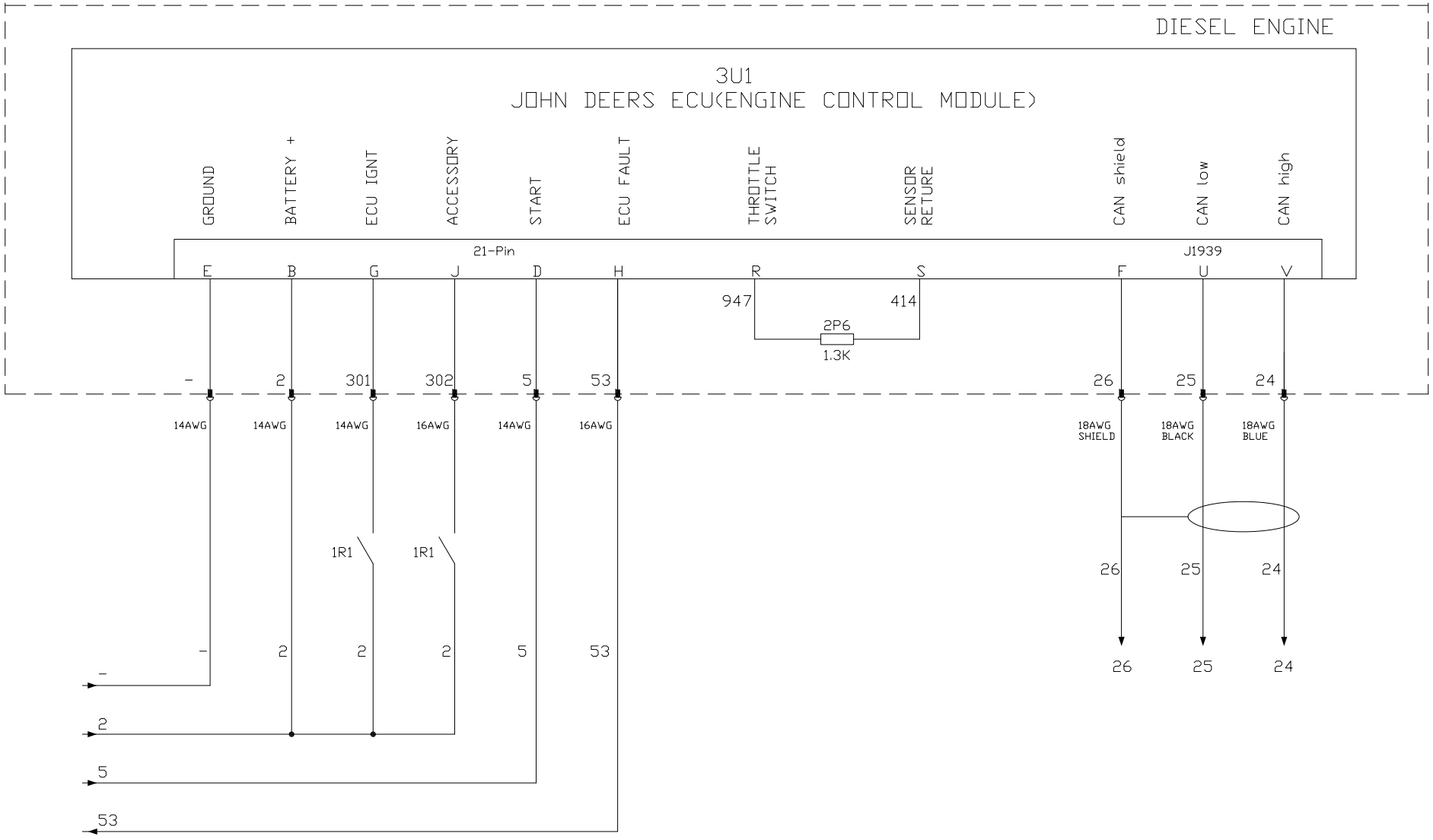
PART NAME: START PANEL

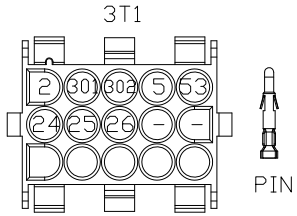
USED FOR: APD-ULJ300/350/400/500 (JOHN DEERE 6090HF/6135HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362086UL | PAGE 2-4

REVISION NO.: 08




ENGINE ECM CABLE



| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| H | add running signal | 2018.02.01 | HELEN |
| G | Change water heater power | 2017.12.13 | LJQ |
| F | Change water heater circuit | 2017.02.07 | Huang |
| E | Change terminal 80B,N(80) to ZDU4 | 2016.12.26 | CAOKUN |
| D | Change terminal heater 80B,N(80) | 2016.12.13 | CAOKUN |
| C | Change PANEL PARTS | 2016.05.10 | CAOKUN |
| B | Change DSE7320 MKII | 2016.04.25 | CAOKUN |
| A | Change start system DC24V | 2016.03.29 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 02.01 | HELEN | |
| CONTROLED BY | 02.01 | TOM | |
| APPROVED BY | 02.01 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

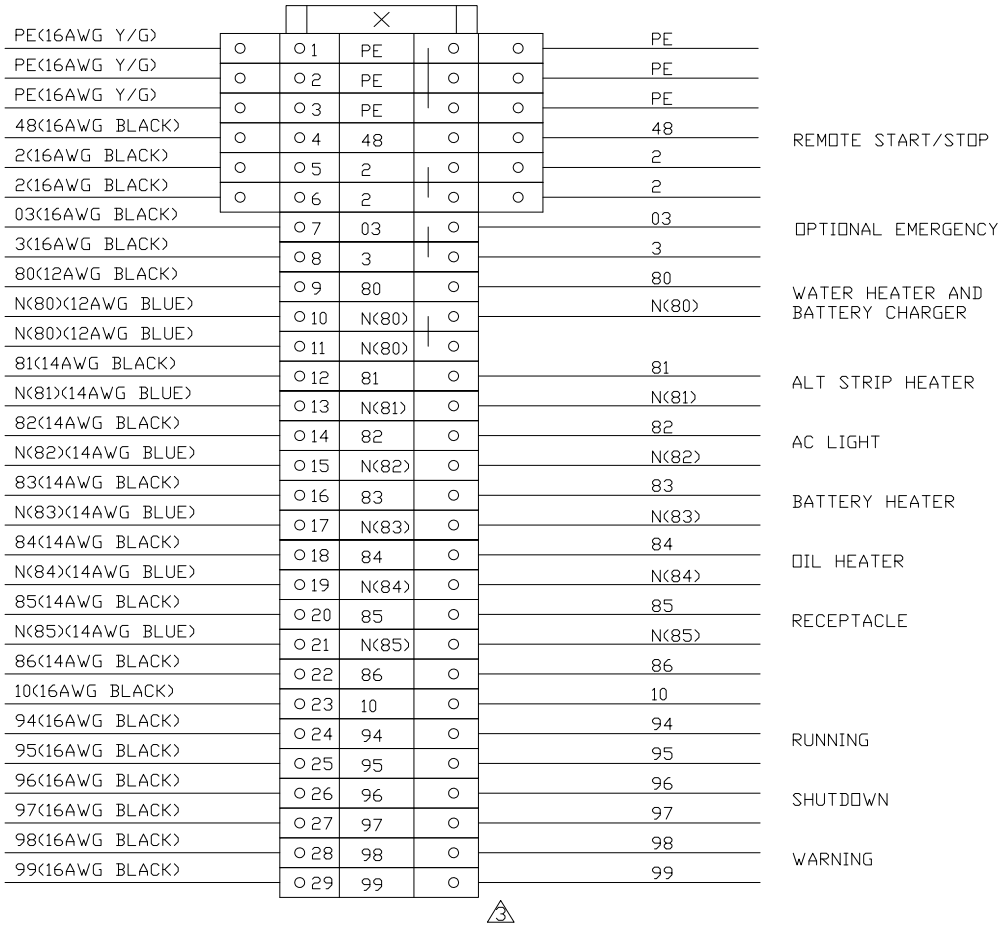
PART NAME: START PANEL

USED FOR: APD-ULJ300/350/400/500
(JOHN DEERE 6090HF/6135HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362086UL | PAGE 3-4

REVISION NO.: 08




| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 22 | 2H1 | WATER HEATER UL | UL Approved (ANSI/IEEEC57.13) |
| 21 | 2CT1 | CURRENT TRANSFORMER UL | UL 1977 |
| 20 | 3T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 19 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 18 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 17 | 1T1 | TYCO 12HOLE 1-480709-0 | UL 248 |
| 16 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 489 |
| 15 | 2F5 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 2F1 | ABB S201P K25A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 1F2 | ABB S201U K32A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 11 | 1F1 | ABB S201U K3A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 10 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 09 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 08 | 1U1 | BATTERY CHARGE AC230V/DC24V | UL 1236 |
| 07 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 06 | 1S7 | LOW WATER LEVEL SWITCH | |
| 05 | 1S6 | FEXIBLE SENSOR | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z24/SCHEIDER 389FXBXC1-24D DC24V 25A | UL 508 |
| 01 | 1R8,1R9,1R11 | DRM270024LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

① :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

② :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

③ :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7,8,12~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059). 9~11,01~02#Terminal model:Weidmuller ZDU4 UL(UL1059).

| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| H | add running signal | 2018.02.01 | HELEN |
| G | Change water heater power | 2017.12.13 | LJQ |
| F | Change water heater circuit | 2017.02.07 | Huang |
| E | Change terminal 80B,N(80) to ZDU4 | 2016.12.26 | CAOKUN |
| D | Change terminal heater 80B,N(80) | 2016.12.13 | CAOKUN |
| C | Change PANEL PARTS | 2016.05.10 | CAOKUN |
| B | Change DSE7320 MKII | 2016.04.25 | CAOKUN |
| A | Change start system DC24V | 2016.03.29 | CAOKUN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 02.01 | HELEN | |
| CONTROLED BY | 02.01 | TOM | |
| APPROVED BY | 02.01 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

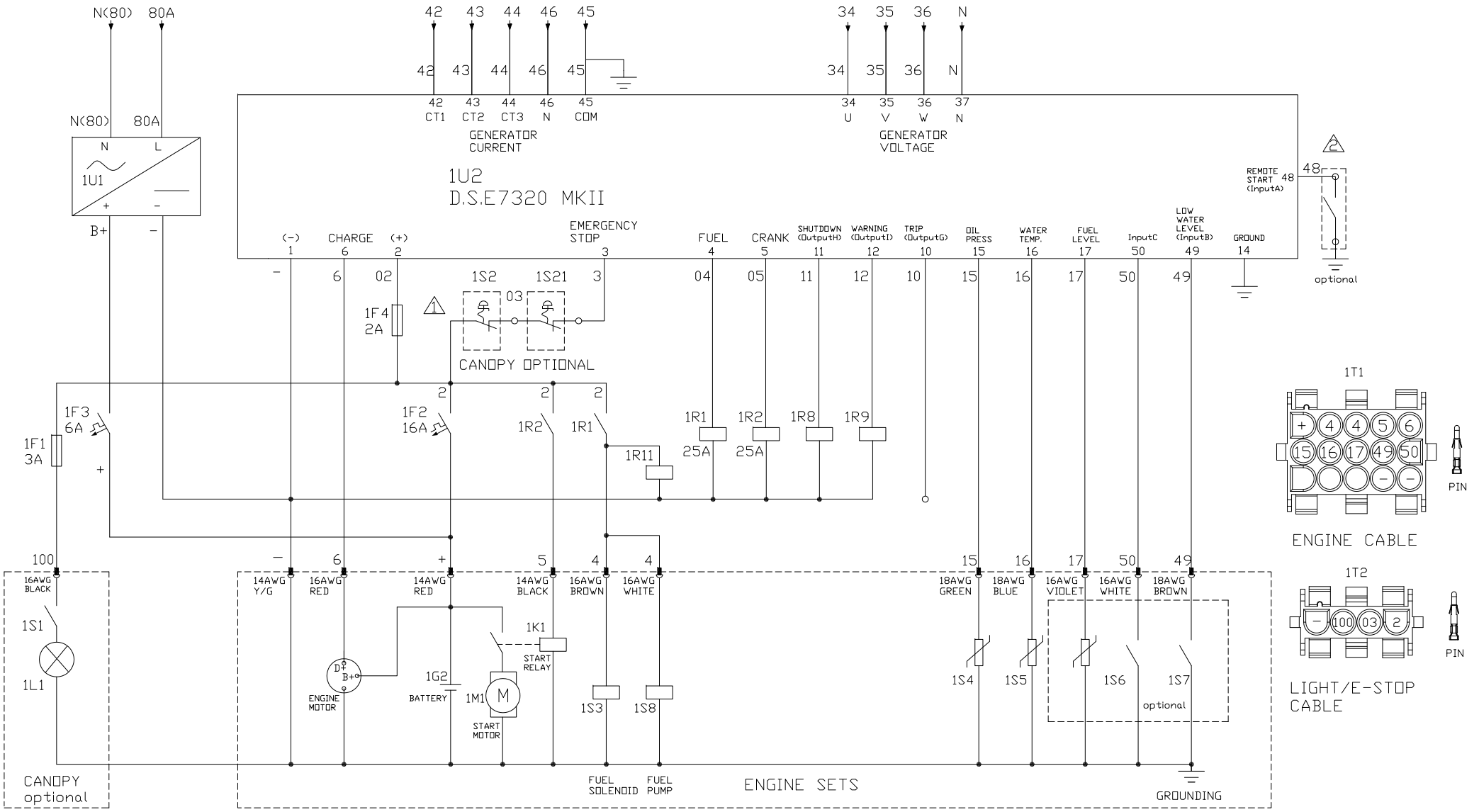
USED FOR: APD-ULJ300/350/400/500 (JOHN DEERE 6090HF/6135HF DC24V DSE7320MKII)

PART NO.: | LOCATION: | A4

DRAWING NO.: SP.J2362086UL | PAGE 4-4

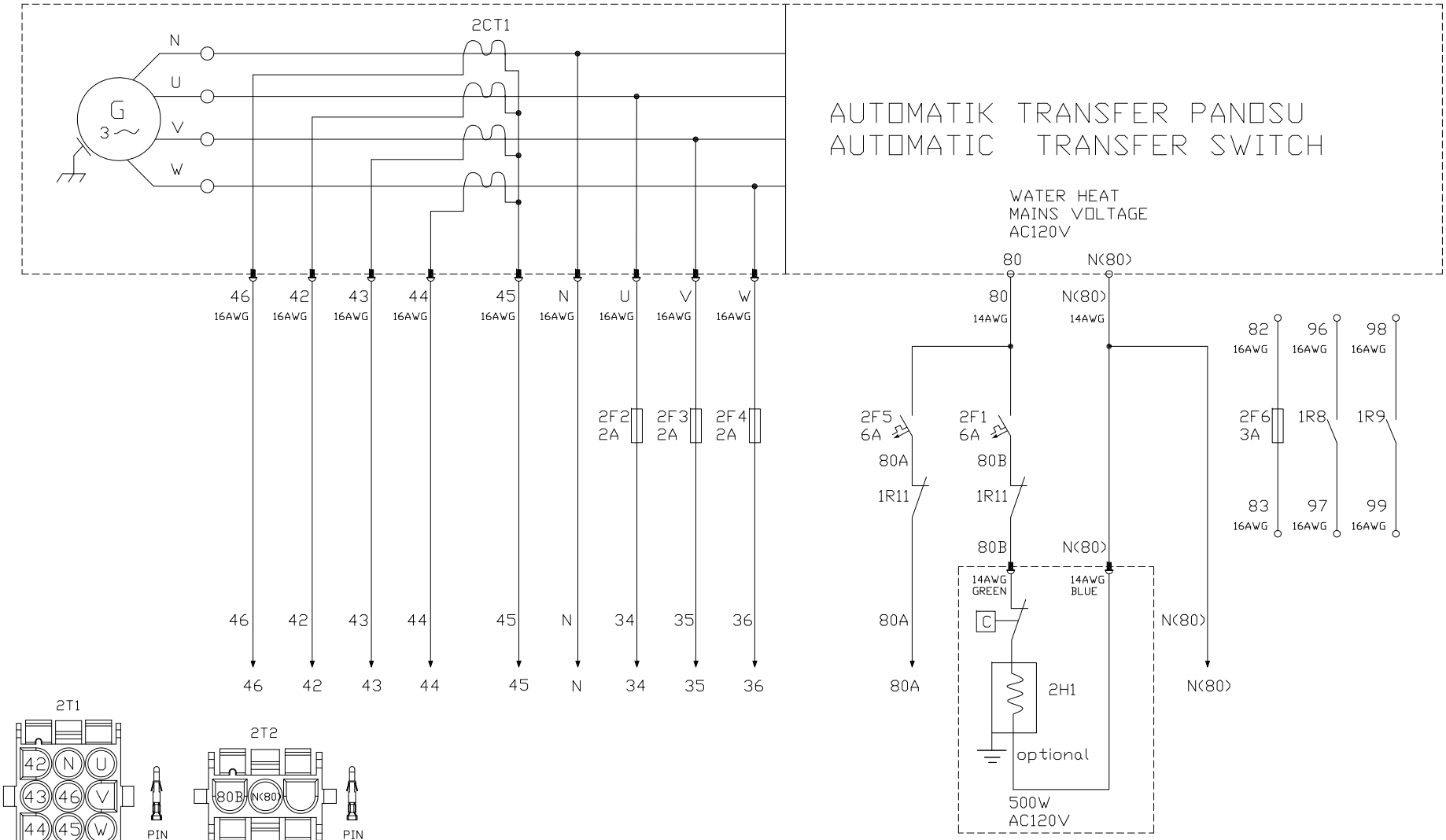
REVISION NO.: 08

# APD-ULP9 – 30



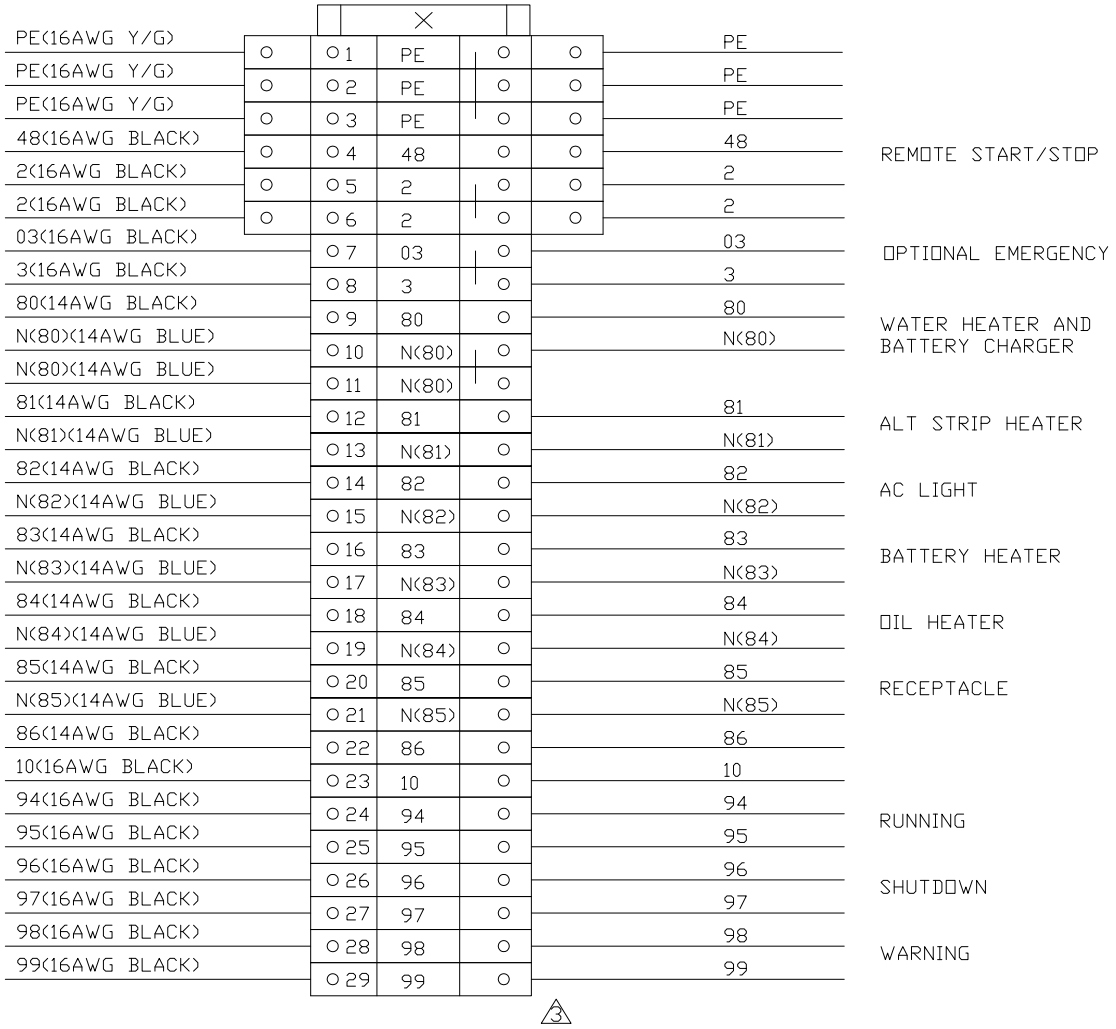



| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP9/13/20/28/30(PERKINS 403D/404D DSE7320) | |
| | CONTROLED BY 10.25 TOM | | |
| | APPROVED BY 10.25 TOTO | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| SIGN / VARIATION / DATE / NAME | aksa POWER GENERATION | DRAWING NO.: SP.P2362080 UL | PAGE 1-3 |
| | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |






| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP9/13/20/28/30(PERKINS 403D/404D DSE7320) | |
| | CONTROLED BY 10.25 TOM | | |
| | APPROVED BY 10.25 TOTO | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| | aksa POWER GENERATION | DRAWING NO.: SP.P2362080 UL | PAGE 2-3 |
| SIGN / VARIATION / DATE / NAME | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |






| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 25 | 2H1 | WATER HEATER UL | |
| 24 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEE C57.13) |
| 23 | 2T2 | TYCO 3HOLE 1-480701-0 | UL 1977 |
| 22 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 21 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 20 | 1T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 19 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 18 | 2F5 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 17 | 2F1 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 16 | 1F3 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 1F2 | ABB S201U K16A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F1,2F6 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 13 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 12 | 1U1 | BATTERY CHARGE AC230V/DC12V | UL 1236 |
| 11 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 10 | 1S8 | FUEL PUMP | |
| 09 | 1S7 | LOW WATER LEVEL SWITCH | |
| 08 | 1S6 | FEXIBLE SENSOR | |
| 07 | 1S5 | WATER TEMPERATURE SENSOR | |
| 06 | 1S4 | OIL PRESSURE SENSOR | |
| 05 | 1S3 | FUEL SOLENOID | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z12 UL DC12V 25A | UL 508 |
| 01 | 1R8,1R9,1R11 | DRM270012LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

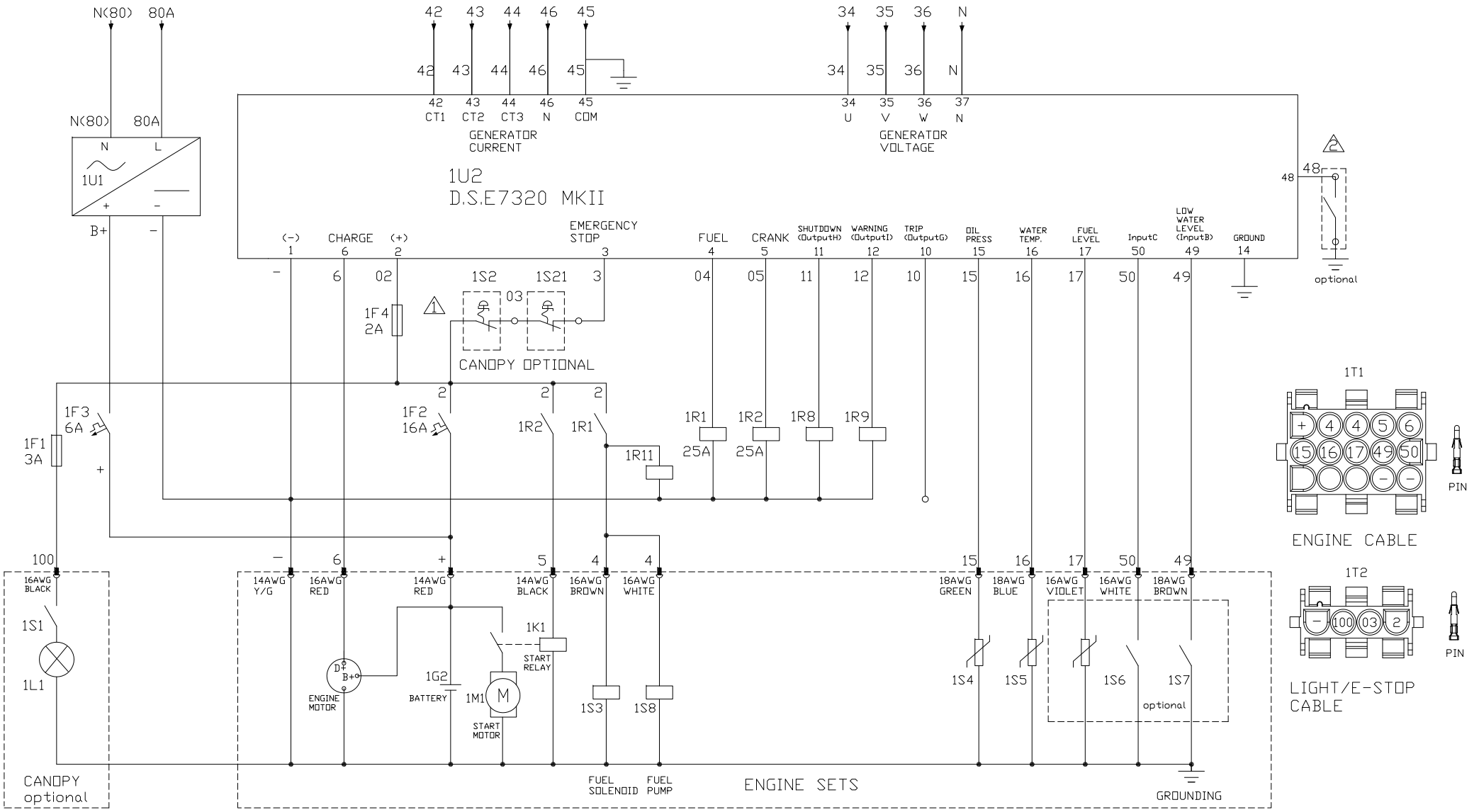
1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059).

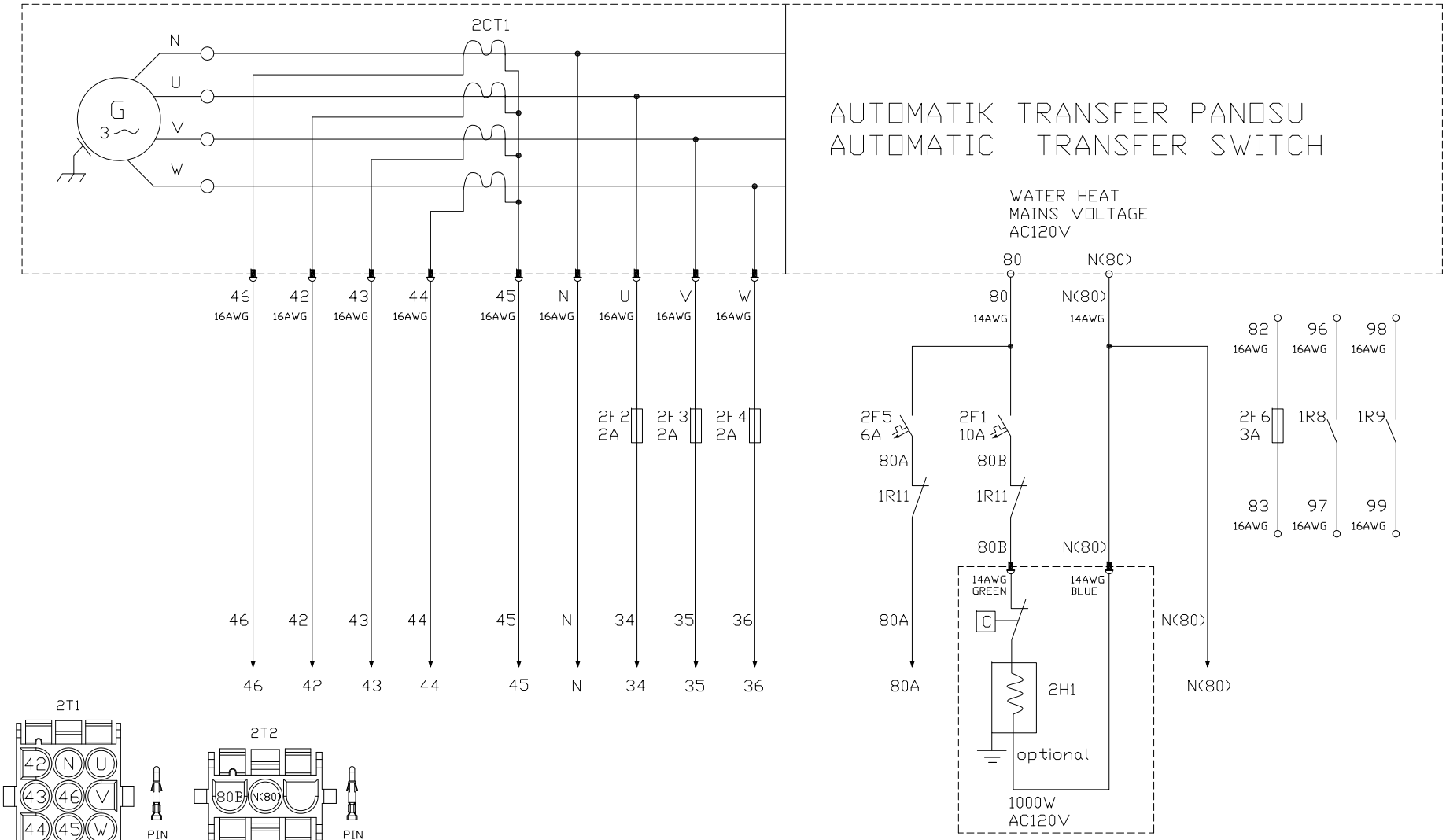
| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP9/13/20/28/30(PERKINS 403D/404D DSE7320) | |
| | CONTROLED BY 10.25 TOM | | |
| | APPROVED BY 10.25 TOTO | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| SIGN / VARIATION / DATE / NAME | aksa POWER GENERATION | DRAWING NO.: SP.P2362080 UL | PAGE 3-3 |
| | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |

# APD-ULP56



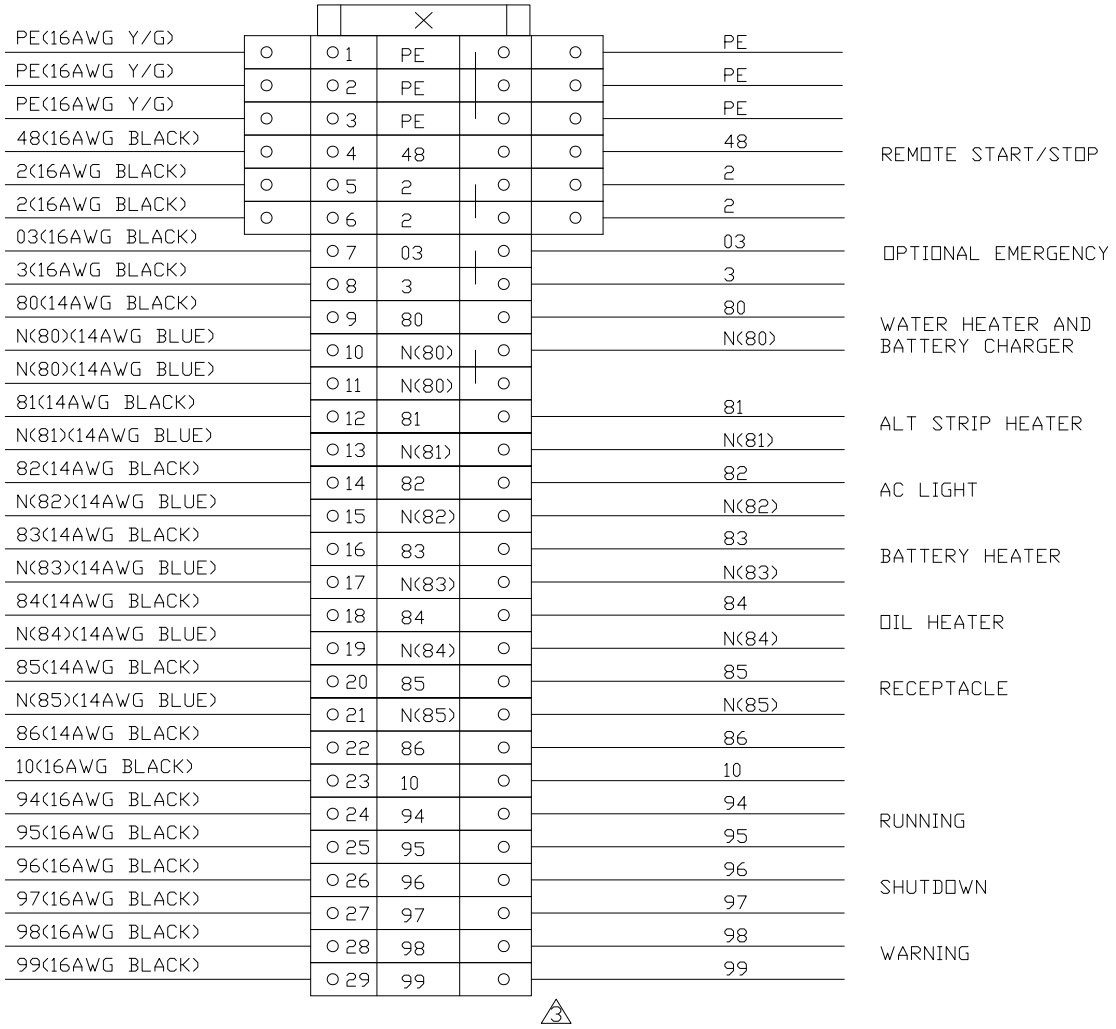



| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP56(PERKINS 1104D-44TG1 DSE7320) | |
| | CONTROLED BY 10.25 TOM | | |
| | APPROVED BY 10.25 TOTO | | |
| | DEPARTMENT: ENGINEERING | PART NO.: / LOCATION: | A4 |
| | aksa POWER GENERATION | DRAWING NO.: SP.P2362081 UL | PAGE 1-3 |
| SIGN / VARIATION / DATE / NAME | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |






| | | | |
|---|---|---|---|
| ORDER CODE: | | SCALE: 1:1 | MATERIAL: / QUANTITY: / WEIGHT: |
| | | 2015 DATE NAME SIGNITURE | PART NAME: START PANEL |
| | | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP56(PERKINS 1104D-44TG1 DSE7320) |
| | | CONTROLED BY 10.25 TOM | |
| | | APPROVED BY 10.25 TOTO | |
| | | DEPARTMENT: ENGINEERING | |
| | | aksa POWER GENERATION | PART NO.: / LOCATION: A4 / PAGE 2-3 |
| | | | DRAWING NO.: SP.P2362081 UL |
| SIGN VARIATION | DATE NAME | | REVISION NO.: 00 |






| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 25 | 2H1 | WATER HEATER UL | |
| 24 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEE C57.13) |
| 23 | 2T2 | TYCO 3HOLE 1-480701-0 | UL 1977 |
| 22 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 21 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 20 | 1T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 19 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 18 | 2F5 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 17 | 2F1 | ABB S201UP K10A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 16 | 1F3 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 1F2 | ABB S201U K16A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F1,2F6 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 13 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 12 | 1U1 | BATTERY CHARGE AC230V/DC12V | UL 1236 |
| 11 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 10 | 1S8 | FUEL PUMP | |
| 09 | 1S7 | LOW WATER LEVEL SWITCH | |
| 08 | 1S6 | FEXIBLE SENSOR | |
| 07 | 1S5 | WATER TEMPERATURE SENSOR | |
| 06 | 1S4 | OIL PRESSURE SENSOR | |
| 05 | 1S3 | FUEL SOLENOID | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z12 UL DC12V 25A | UL 508 |
| 01 | 1R8,1R9,1R11 | DRM270012LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

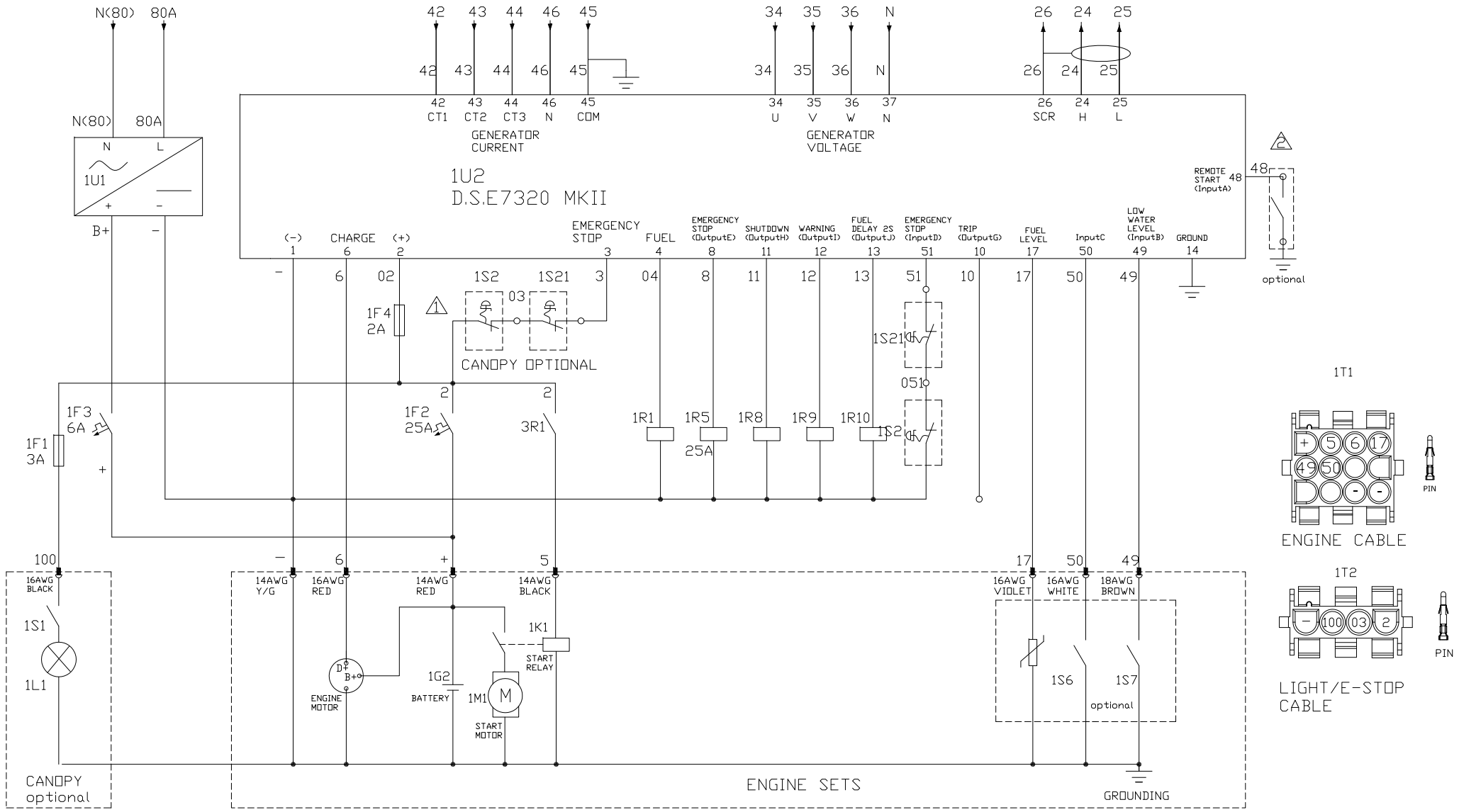
1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059).

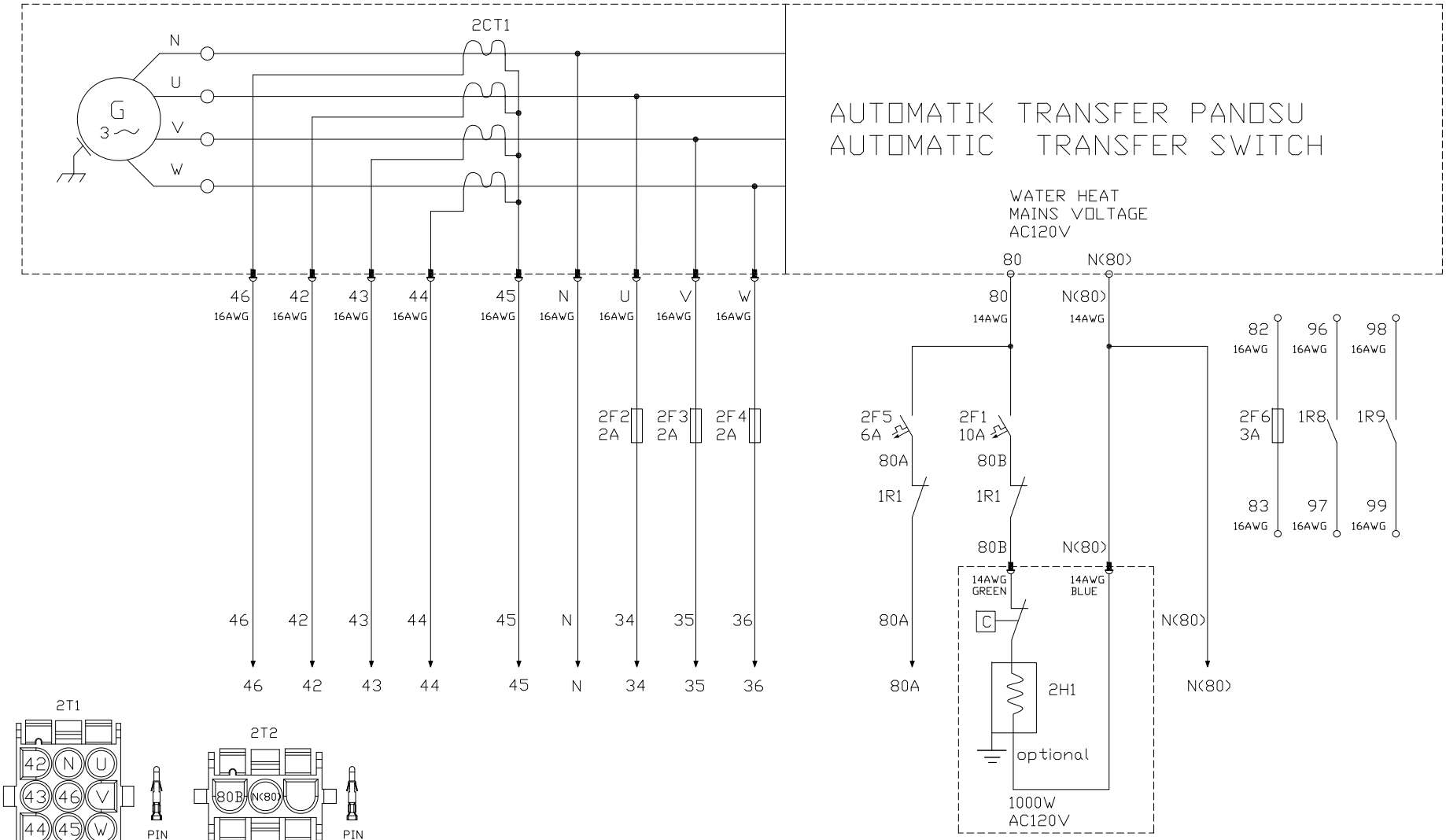
| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP56(PERKINS 1104D-44TG1 DSE7320) | |
| | CONTROLED BY 10.25 TOM | | |
| | APPROVED BY 10.25 TOTO | | |
| | DEPARTMENT: ENGINEERING | | |
| SIGN / VARIATION / DATE / NAME | aksa POWER GENERATION | PART NO.: / LOCATION: A4 | |
| | | DRAWING NO.: SP.P2362081 UL | PAGE 3-3 |
| | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |

# APD-ULP65 – 100



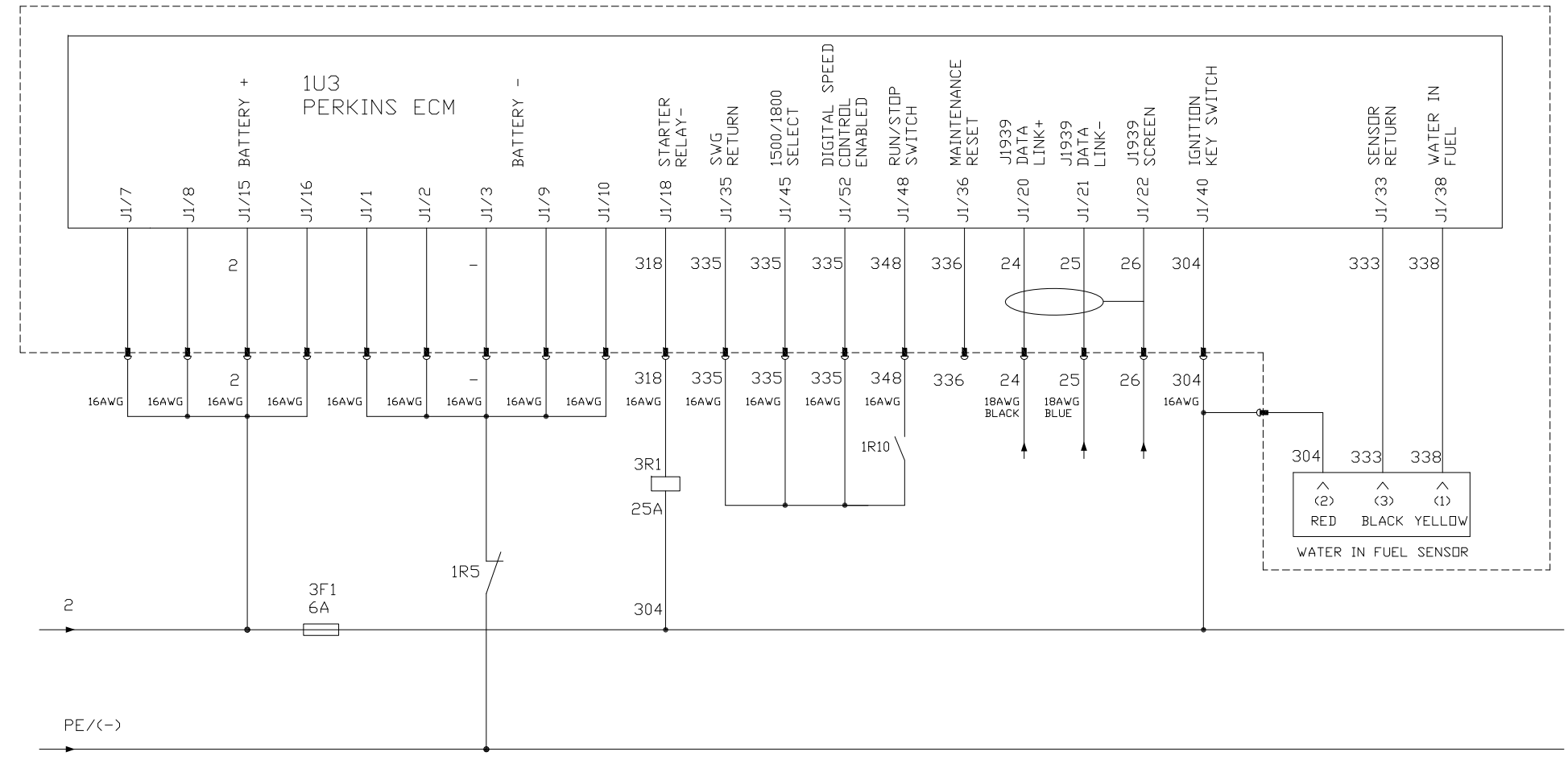



| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: | WEIGHT: |
|---|---|---|---|---|
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP65/82/100(PERKINS 1104D-E44 DSE7320) | | |
| | CONTROLED BY 10.25 TOM | | | |
| | APPROVED BY 10.25 TOTO | | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: | A4 |
| | aksa POWER GENERATION | DRAWING NO.: SP.P2362082 UL | | PAGE 1-4 |
| SIGN / VARIATION / DATE / NAME | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. | |

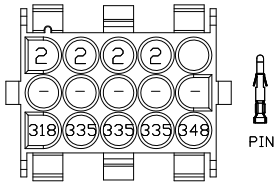




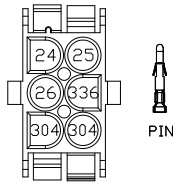

| | | | |
|---|---|---|---|
| ORDER CODE: | | SCALE: 1:1 | MATERIAL: / QUANTITY: / WEIGHT: |
| | | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL |
| | | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP65/82/100(PERKINS 1104D-E44 DSE7320) |
| | | CONTROLED BY 10.25 TOM | |
| | | APPROVED BY 10.25 TOTO | |
| | | DEPARTMENT: ENGINEERING | PART NO.: / LOCATION: A4 |
| | | aksa POWER GENERATION | DRAWING NO.: SP.P2362082 UL / PAGE 2-4 |
| SIGN / VARIATION / DATE / NAME | | | REVISION NO.: 00 |




3T1




3T2




ENGINE ECM CABLE



| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2015 / DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 10.25 CAOKUN | USED FOR: APD-ULP65/82/100(PERKINS 1104D-E44 DSE7320) | |
| | CONTROLED BY 10.25 TOM | | |
| | APPROVED BY 10.25 TOTO | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| SIGN / VARIATION / DATE / NAME | aksa POWER GENERATION | DRAWING NO.: SP.P2362082 UL | PAGE 3-4 |
| | | REVISION NO.: 00 | ONLY ENGINERRING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |

| | | | |
|---|---|---|---|
| PE(16AWG Y/G) | 1 | PE | PE |
| PE(16AWG Y/G) | 2 | PE | PE |
| PE(16AWG Y/G) | 3 | PE | PE |
| 60(16AWG BLACK) | 4 | 60 | 60 |
| 2(16AWG BLACK) | 5 | 2 | 2 |
| 2(16AWG BLACK) | 6 | 2 | 2 |
| 03(16AWG BLACK) | 7 | 03 | 03 |
| 3(16AWG BLACK) | 8 | 3 | 3 |
| 051(16AWG BLACK) | 9 | 051 | 051 |
| 51(16AWG BLACK) | 10 | 51 | 51 |
| 80(14AWG BLACK) | 11 | 80 | 80 |
| N(80)(14AWG BLUE) | 12 | N(80) | N(80) |
| N(80)(14AWG BLUE) | 13 | N(80) | |
| 81(14AWG BLACK) | 14 | 81 | 81 |
| N(81)(14AWG BLUE) | 15 | N(81) | N(81) |
| 82(14AWG BLACK) | 16 | 82 | 82 |
| N(82)(14AWG BLUE) | 17 | N(82) | N(82) |
| 83(14AWG BLACK) | 18 | 83 | 83 |
| N(83)(14AWG BLUE) | 19 | N(83) | N(83) |
| 84(14AWG BLACK) | 20 | 84 | 84 |
| N(84)(14AWG BLUE) | 21 | N(84) | N(84) |
| 85(14AWG BLACK) | 22 | 85 | 85 |
| N(85)(14AWG BLUE) | 23 | N(85) | N(85) |
| 86(14AWG BLACK) | 24 | 86 | 86 |
| 10(16AWG BLACK) | 25 | 10 | 10 |
| 94(16AWG BLACK) | 26 | 94 | 94 |
| 95(16AWG BLACK) | 27 | 95 | 95 |
| 96(16AWG BLACK) | 28 | 96 | 96 |
| 97(16AWG BLACK) | 29 | 97 | 97 |
| 98(16AWG BLACK) | 30 | 98 | 98 |
| 99(16AWG BLACK) | 31 | 99 | 99 |

REMOTE START/STOP

OPTIONAL EMERGENCY

OPTIONAL EMERGENCY

WATER HEATER AND BATTERY CHARGER

ALT STRIP HEATER

AC LIGHT

BATTERY HEATER

OIL HEATER

RECEPTACLE

RUNNING

SHUTDOWN

WARNING

△3

△1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel.1S21 is optional emergency stop.

△2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

△3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7~31#Terminal model:Weidmuller ZDU2.5 UL(UL1059).

| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 22 | 2H1 | WATER HEATER UL | |
| 22 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEE C57.13) |
| 21 | 3T2 | TYCO 6HOLE 1-480705-0 | UL 1977 |
| 20 | 3T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 19 | 2T2 | TYCO 3HOLE 1-480701-0 | UL 1977 |
| 18 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 17 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 16 | 1T1 | TYCO 12HOLE 1-480709-0 | UL 1977 |
| 15 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 14 | 2F5 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 2F1 | ABB S201UP K10A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 1F3 | ABB S201U K6A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 11 | 1F2 | ABB S201U K25A-1P UL (HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 10 | 1F1,2F6 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 09 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 08 | 1U1 | BATTERY CHARGE AC230V/DC12V | UL 1236 |
| 07 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 06 | 1S7 | LOW WATER LEVEL SWITCH | |
| 05 | 1S6 | FEXIBLE SENSOR | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R5,3R1 | ROCKWELL 700-HHF62Z12 UL DC12V 25A | UL 508 |
| 01 | 1R1,1R8,1R9,1R10 | DRM270012LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| | | | |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2015 | | | |
| DRAWINGED BY | 10.25 | CAOKUN | |
| CONTROLED BY | 10.25 | TOM | |
| APPROVED BY | 10.25 | TOTO | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

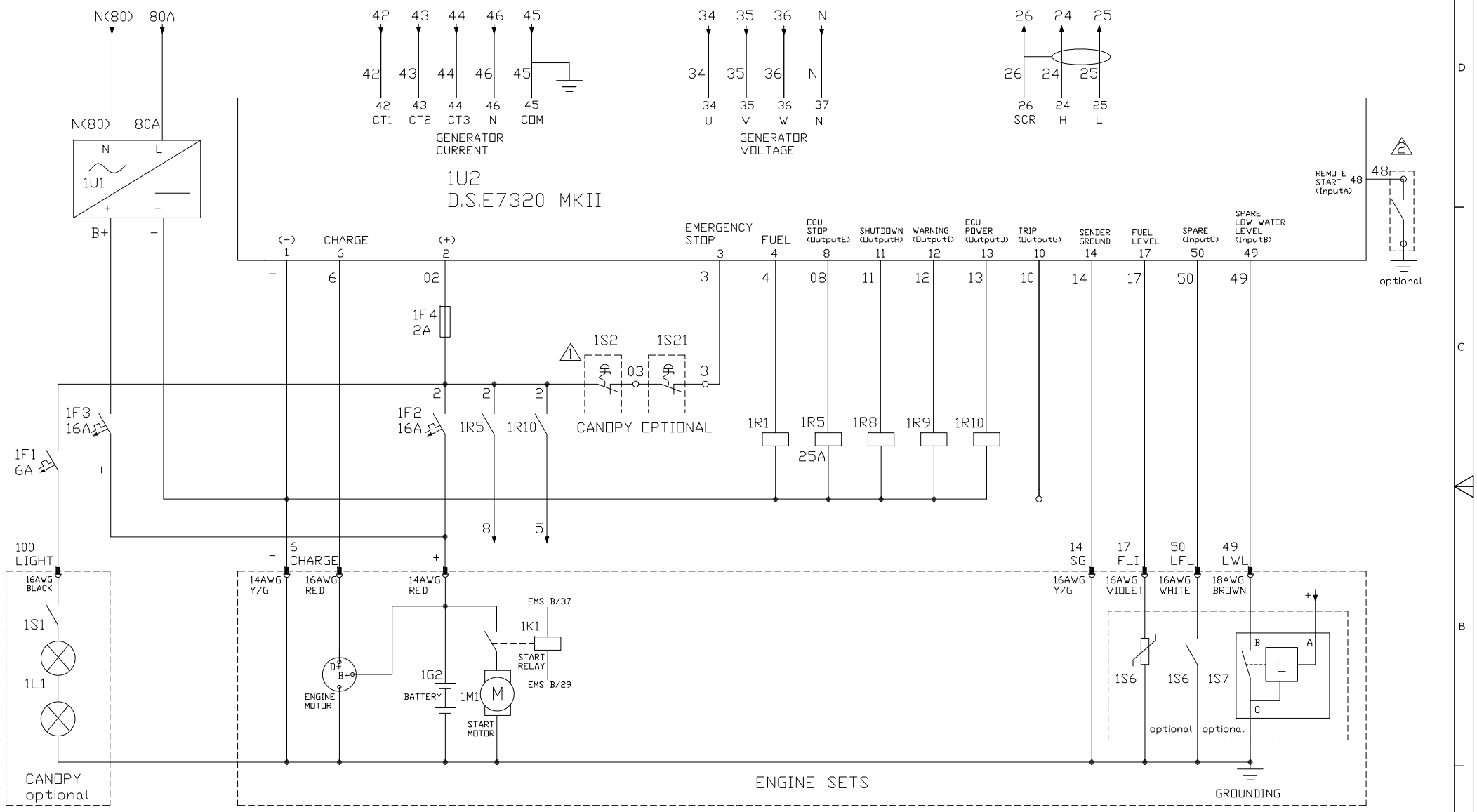
USED FOR: APD-ULP65/82/100(PERKINS 1104D-E44 DSE7320)

PART NO.: | LOCATION: A4 | PAGE 4-4

DRAWING NO.: SP.P2362082 UL

REVISION NO.: 00

# APD-ULV250 - 600






| ORDER CODE: | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| A | add running signal | 2018.02.07 | HELEN |
| SIGN | VARIATION | DATE | NAME |

SCALE: 1:1

| 2018 | DATE | NAME | SIGNITURE |
|---|---|---|---|
| DRAWINGED BY | 02.07 | HELEN | |
| CONTROLED BY | 02.07 | TOM | |
| APPROVED BY | 02.07 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

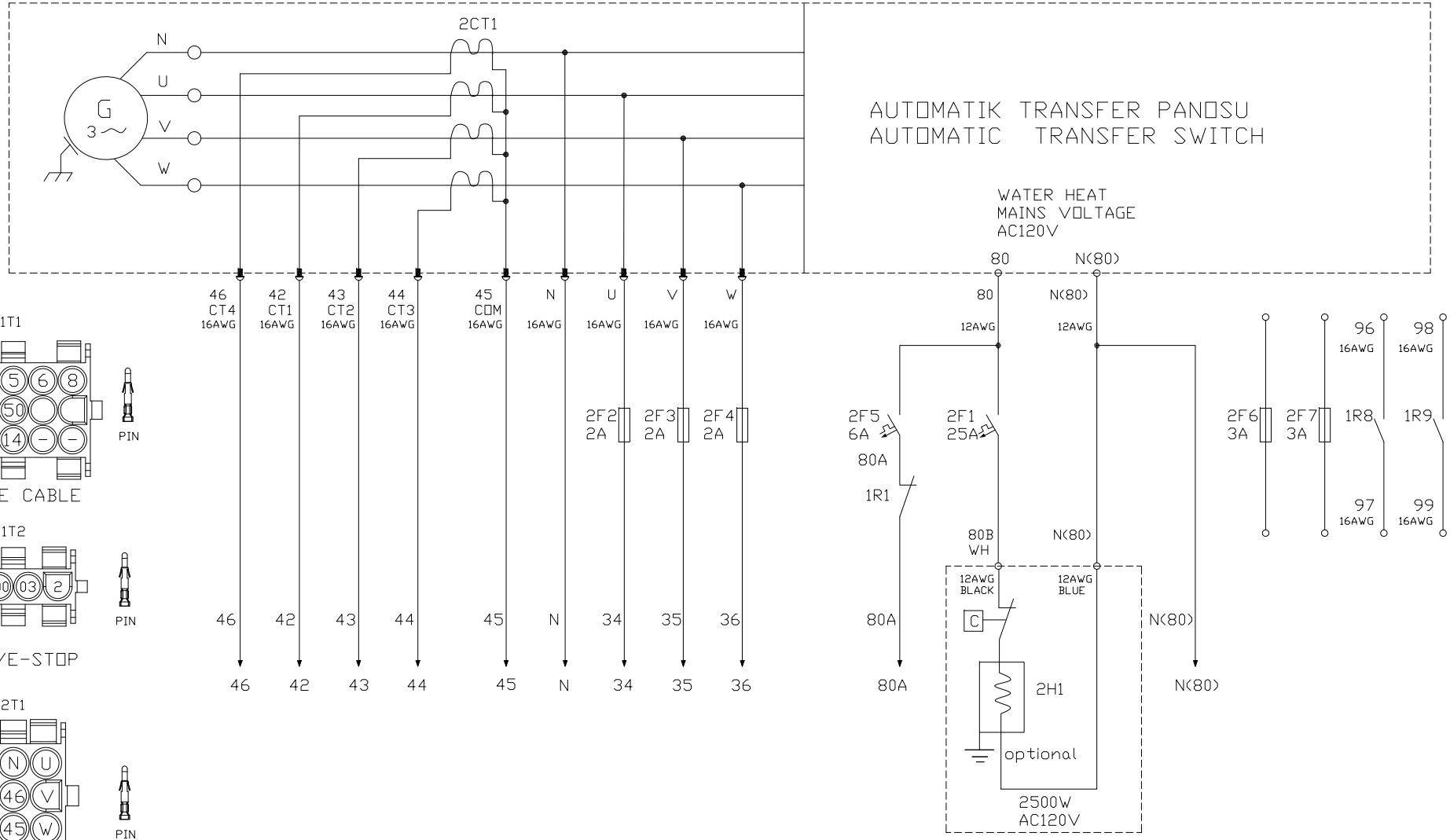
USED FOR: APD-ULV250/350/400/450/500/550/600
(VOLVO TAD135x/TAD16xx/TWD1643 DSE7320MKII)

PART NO.: | LOCATION: | A4 | PAGE 1-4

DRAWING NO.: SP.V2M362001UL

REVISION NO.: 01

# AUTOMATIK TRANSFER PANOSU
# AUTOMATIC TRANSFER SWITCH






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| A | add running signal | 2018.02.07 | HELEN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 02.07 | HELEN | |
| CONTROLED BY | 02.07 | TOM | |
| APPROVED BY | 02.07 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

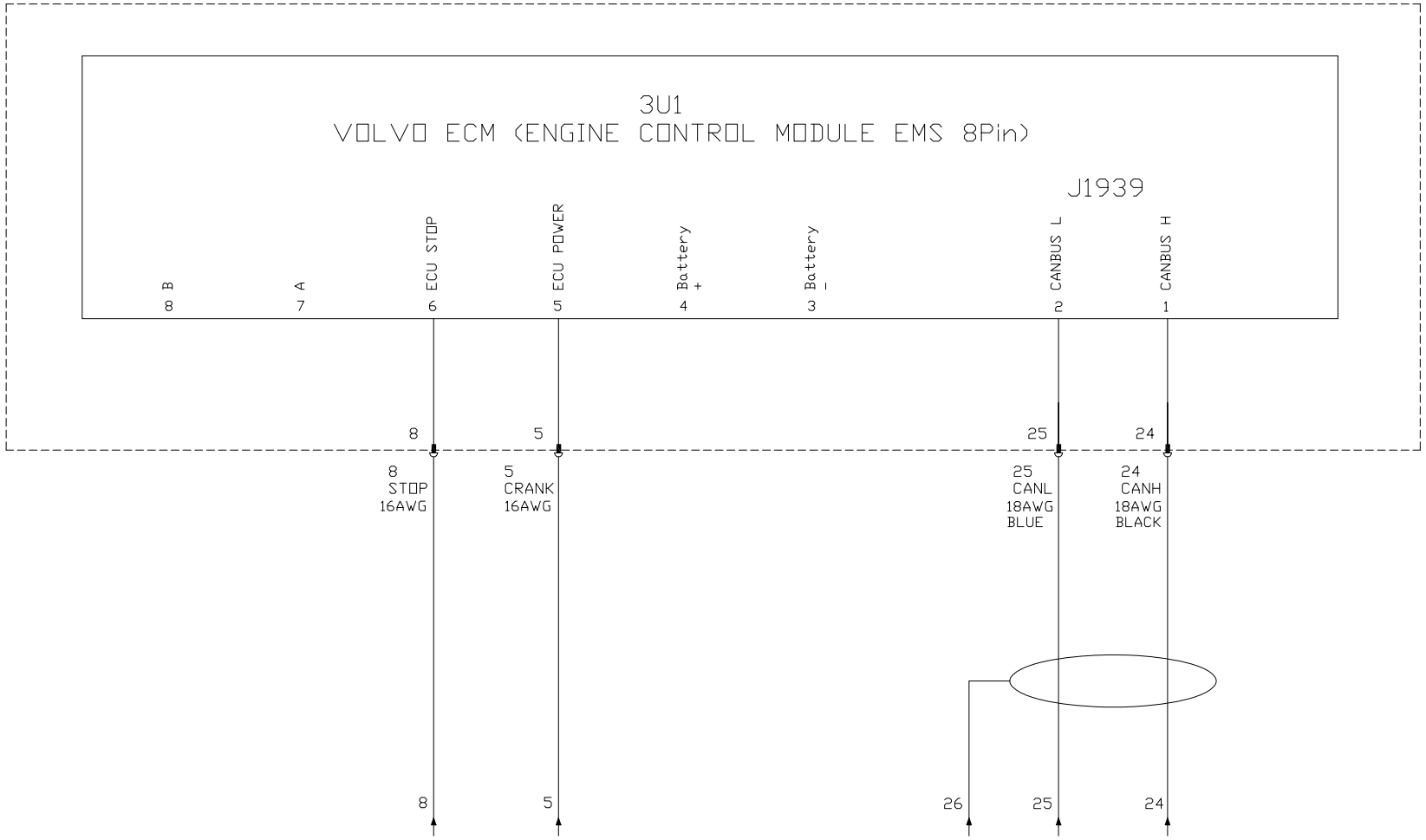
PART NAME: START PANEL

USED FOR: APD-ULV250/350/400/450/500/550/600 (VOLVO TAD135x/TAD16xx/TWD1643 DSE7320MKII)

PART NO.: | LOCATION: | A4 | PAGE 2-4

DRAWING NO.: SP.V2M362001UL

REVISION NO.: 01






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| A | add running signal | 2018.02.07 | HELEN |

ORDER CODE:

SCALE: 1:1

MATERIAL: | QUANTITY: | WEIGHT:

| 2018 | DATE | NAME | SIGNITURE |
|---|---|---|---|
| DRAWINGED BY | 02.07 | HELEN | |
| CONTROLED BY | 02.07 | TOM | |
| APPROVED BY | 02.07 | SAMER | |

DEPARTMENT: ENGINEERING

PART NAME: START PANEL

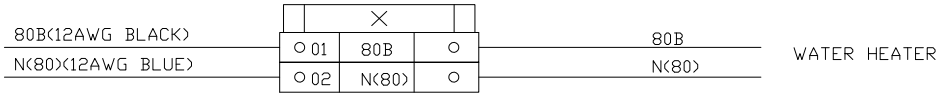
USED FOR: APD-ULV250/350/400/450/500/550/600
(VOLVO TAD135x/TAD16xx/TWD1643 DSE7320MKII)

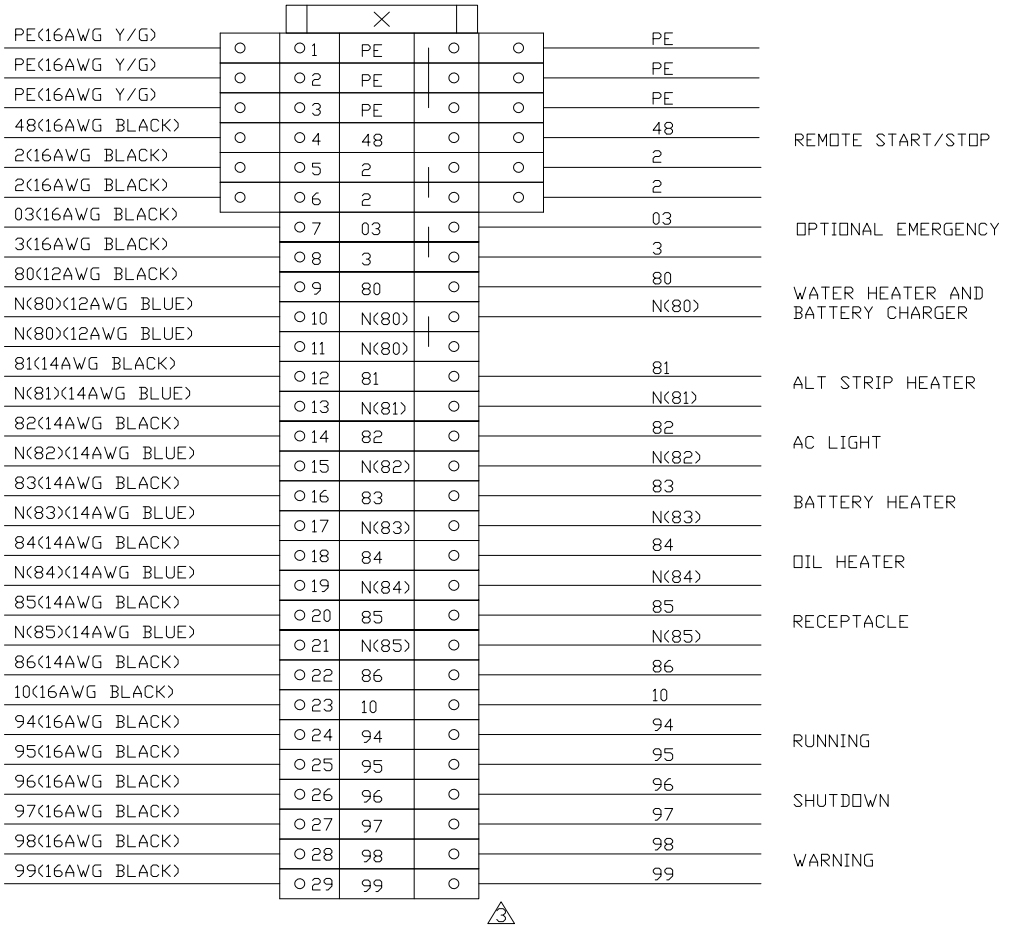
aksa POWER GENERATION

PART NO.: | LOCATION: | A4 | PAGE 3-4

DRAWING NO.: SP.V2M362001UL

REVISION NO.: 01






| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 21 | 2H1 | WATER HEATER UL | |
| 20 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEEC57.13) |
| 19 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 18 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 17 | 1T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 16 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 15 | 2F5 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 2F1 | ABB S201U K25A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 1F2 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 11 | 1F1 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 10 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 09 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 08 | 1U1 | BATTERY CHARGE DSE9470 MKII DC24V 10A | UL 1236 |
| 07 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 06 | 1S7 | LOW WATER LEVEL SWITCH | |
| 05 | 1S6 | FEXIBLE SENSOR | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R5 | ROCKWELL 700-HHF62Z24/SCHEIDER 389FXBXC1-24D DC24V 25A | UL 508 |
| 01 | 1R1,1R8 1R9,1R10 | DRM270024LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel. 1S21 is optional emergency stop.

2 :For all Aksa USA UL gensets are using two wire start off of digital input 48 to start the genset up.

3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059). 7,8,12~29#Terminal model:Weidmuller ZDU2.5 UL(UL1059). 9~11,01~02#Terminal model:Weidmuller ZDU4 UL(UL1059).

| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| A | add running signal | 2018.02.07 | HELEN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| 2018 | | | |
| DRAWINGED BY | 02.07 | HELEN | |
| CONTROLED BY | 02.07 | TOM | |
| APPROVED BY | 02.07 | SAMER | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

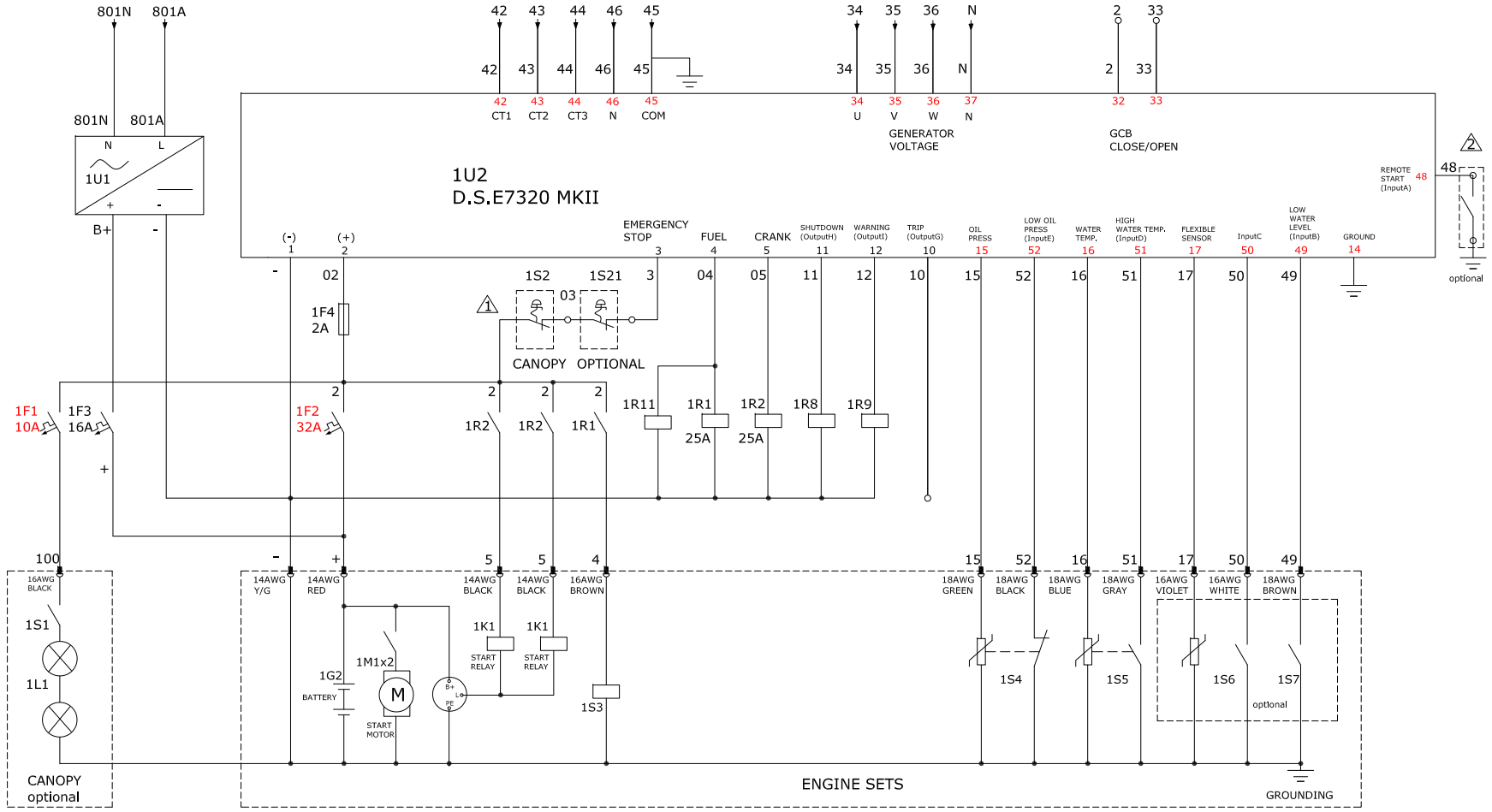
USED FOR: APD-ULV250/350/400/450/500/550/600 (VOLVO TAD135x/TAD16xx/TWD1643 DSE7320MKII)

PART NO.: | LOCATION: | A4 | PAGE 4-4

DRAWING NO.: SP.V2M362001UL

REVISION NO.: 01

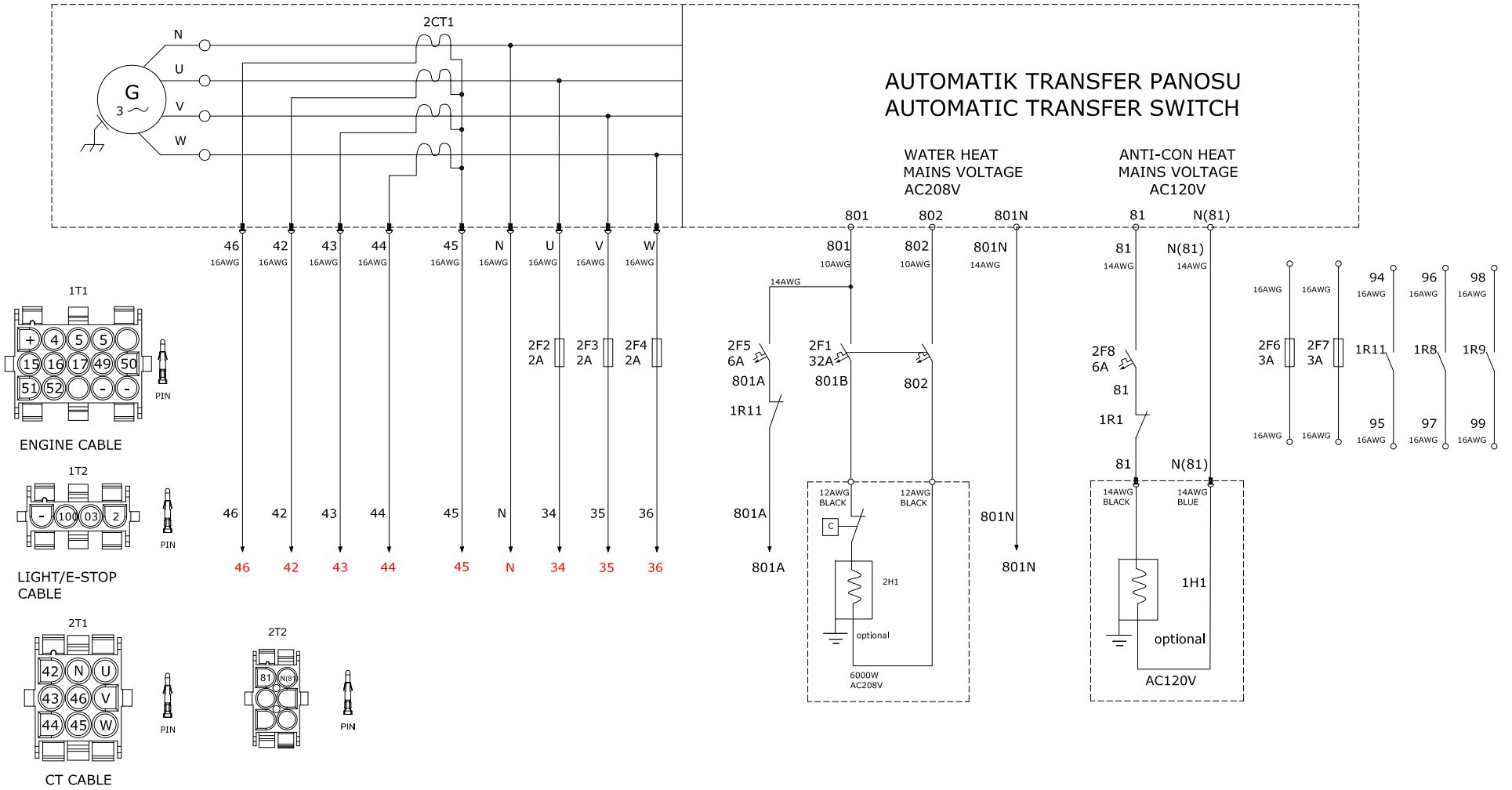
APD-ULM800





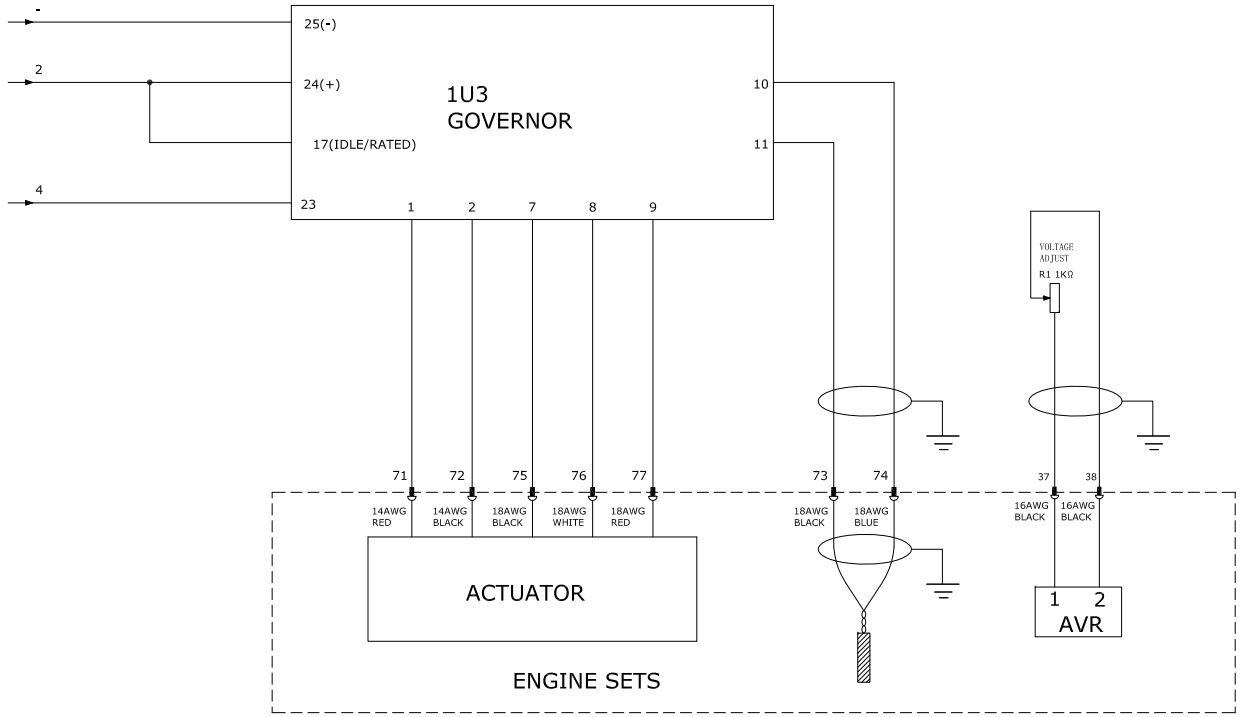

| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2017 DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 12.04 Lujianqiang | USED FOR: APD-ULM800(MITSUBISHI S12A2 DSE7320MKII WITH ANTI-CON/VOLTAGE ADJUST 480/277V)/NO BATTERY CHARGER | |
| | CONTROLED BY 12.04 HELEN | | |
| | APPROVED BY 12.04 TOM | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| | aksa POWER GENERATION | DRAWING NO.: SP.M2364853 UL | PAGE 1-4 |
| SIGN / VARIATION / DATE / NAME | | REVISION NO.: 00 | ONLY ENGINEERING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |

# AUTOMATIK TRANSFER PANOSU
# AUTOMATIC TRANSFER SWITCH

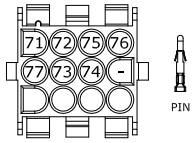





| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2017 DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 12.04 Lujianqiang | USED FOR: APD-ULM800(MITSUBISHI S12A2 DSE7320MKII WITH ANTI-CON/VOLTAGE ADJUST 480/277V)/NO BATTERY CHARGER | |
| | CONTROLED BY 12.04 HELEN | | |
| | APPROVED BY 12.04 TOM | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| | aksa POWER GENERATION | DRAWING NO.: SP.M2364853 UL | PAGE 2-4 |
| SIGN / VARIATION / DATE / NAME | | REVISION NO.: 00 | ONLY ENGINEERING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |

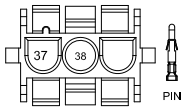



3T1




ENGINE CABLE

4T1

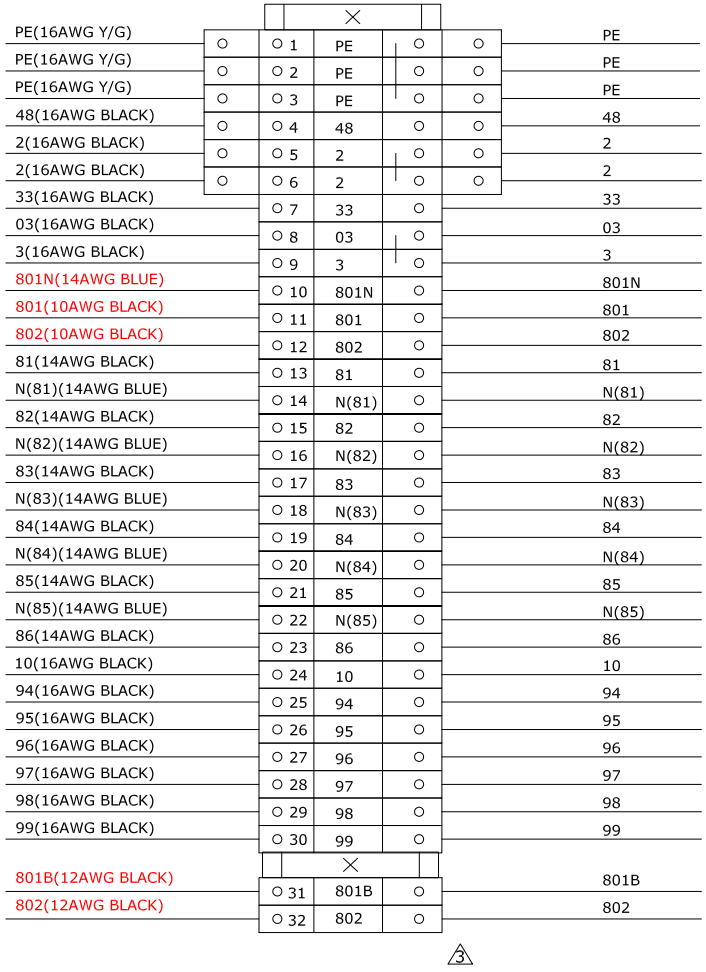



AVR CABLE



| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2017 DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 12.04 Lujianqiang | USED FOR: APD-ULM800(MITSUBISHI S12A2 DSE7320MKII WITH ANTI-CON/VOLTAGE ADJUST 480/277V)/NO BATTERY CHARGER | |
| | CONTROLED BY 12.04 HELEN | | |
| | APPROVED BY 12.04 TOM | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| | aksa POWER GENERATION | DRAWING NO.: SP.M2364853 UL | PAGE 3-4 |
| SIGN / VARIATION / DATE / NAME | | REVISION NO.: 00 | ONLY ENGINEERING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |

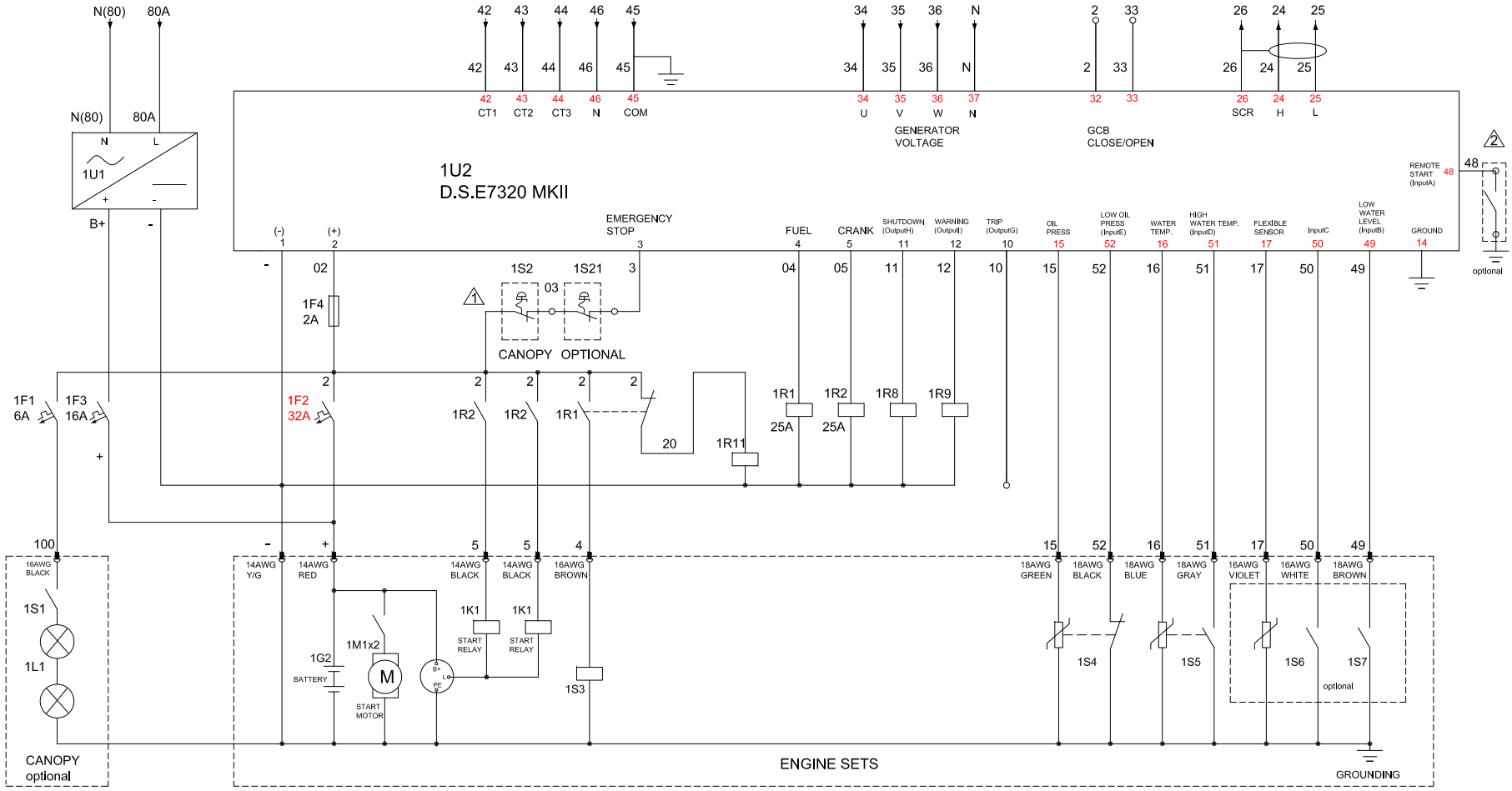
| | | | |
|---|---|---|---|
| 27 | R1 | RESISTANCE 1KΩ 10 TURNS | |
| 26 | 2H1 | WATER HEATER UL | |
| 25 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEEC57.13) |
| 24 | 4T1 | TYCO 3HOLE 1-480709-0 | UL 1977 |
| 23 | 3T1 | TYCO 12HOLE 1-480709-0 | UL 1977 |
| 22 | 2T2 | TYCO 6HOLE 1-480707-0 | UL 1977 |
| 21 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 20 | 1T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 19 | 1T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 18 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 17 | 2F5,2F8 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 16 | 2F1 | ABB S202P K32A-2P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F2 | ABB S201U K32A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 1F1 | ABB S201U K10A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 11 | 1U2 | DEEPSEA7320 MKII MODUEL | UL 508 |
| 10 | 1U1 | BATTERY CHARGE AC230V/DC24V | UL 1236 |
| 09 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 08 | 1S7 | LOW WATER LEVEL SWITCH | |
| 07 | 1S6 | FEXIBLE SENSOR | |
| 06 | 1S5 | WATER TEMP. SENSOR | |
| 05 | 1S4 | OIL PRESS SENSOR | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z24/SCHNEIDER 389FXBXC1-24D DC24V 25A | UL 508 |
| 01 | 1R8,1R9,1R11 | DRM270024LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |
| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |




1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel.1S21 is optional emergency stop.
2 :For all Aksa USA UL gensets are using two wire start off of digital input48 to start the genset up.
3 :1~6#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059);7~10,13~30#Terminal model:Weidmuller ZDU2.5 UL(UL1059).
11~12#Terminal model:Weidmuller ZDU10 UL(UL1059).31~32#Terminal model:Weidmuller ZDU4 UL(UL1059).

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ORDER CODE: | | | SCALE: 1:1 | | MATERIAL: | QUANTITY: | WEIGHT: |
| | | | 2017 | DATE NAME SIGNATURE | PART NAME: START PANEL | | |
| | | | DRAWINGED BY | 12.04 Lufanqiang | | | |
| | | | CONTROLED BY | 12.04 HELEN | | | |
| | | | APPROVED BY | 12.04 TOM | | | |
| | | | DEPARTMENT: ENGINEERING | | USED FOR: APD-ULM800(MITSUBISHI S12A2 DSE7320MKII WITH ANTI-CON/VOLTAGE ADJUST 480/277V)/NO BATTERY CHARGER | | |
| | | | aksa POWER GENERATION | | PART NO.: | LOCATION: | A4 |
| | | | | | DRAWING NO.: SP.M2364853 UL | | PAGE 4-4 |
| SIGN | VARIATION | DATE | NAME | | REVISION NO.: 00 | ONLY ENGINEERING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. | |

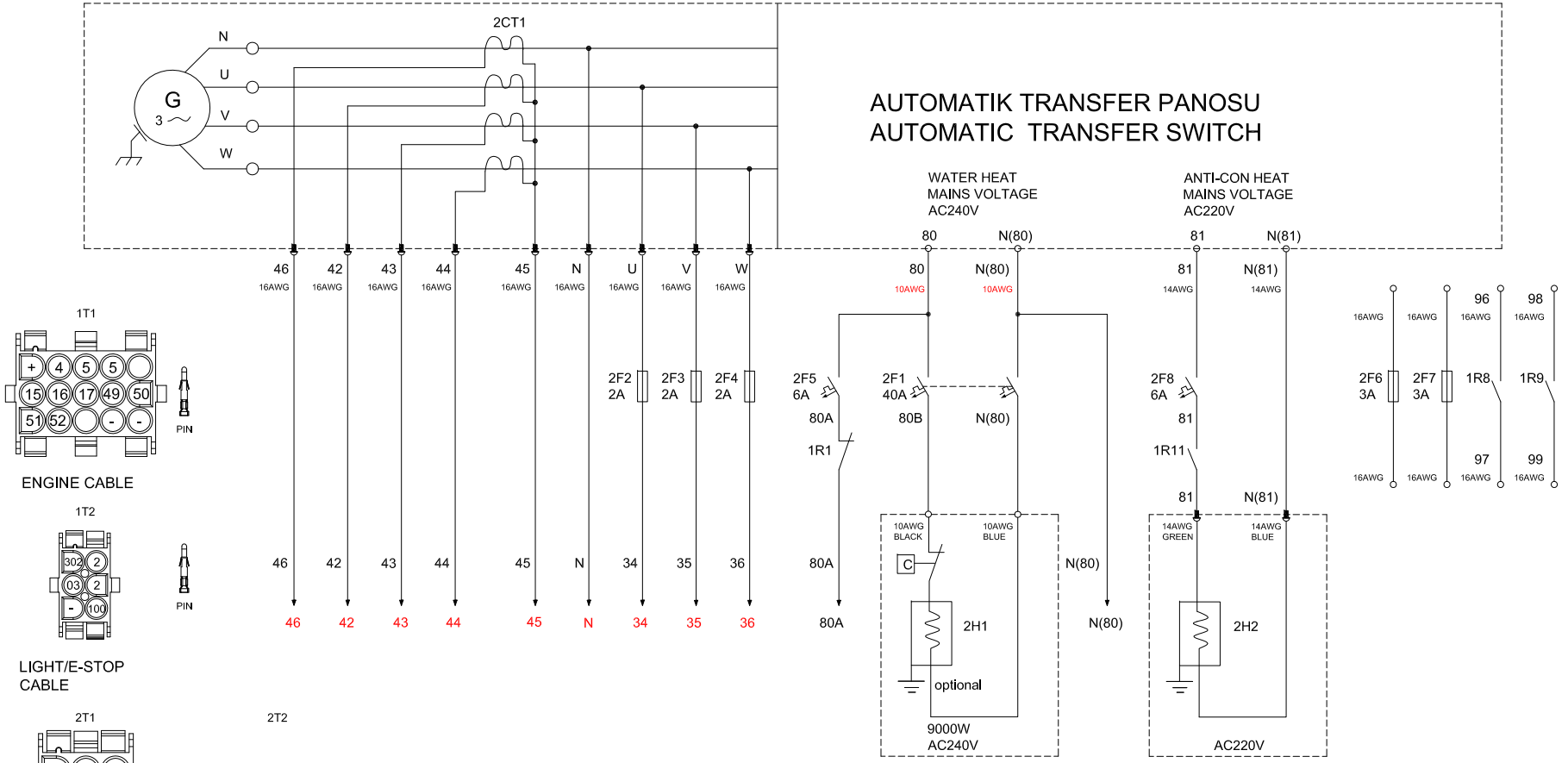
APD-ULM1000





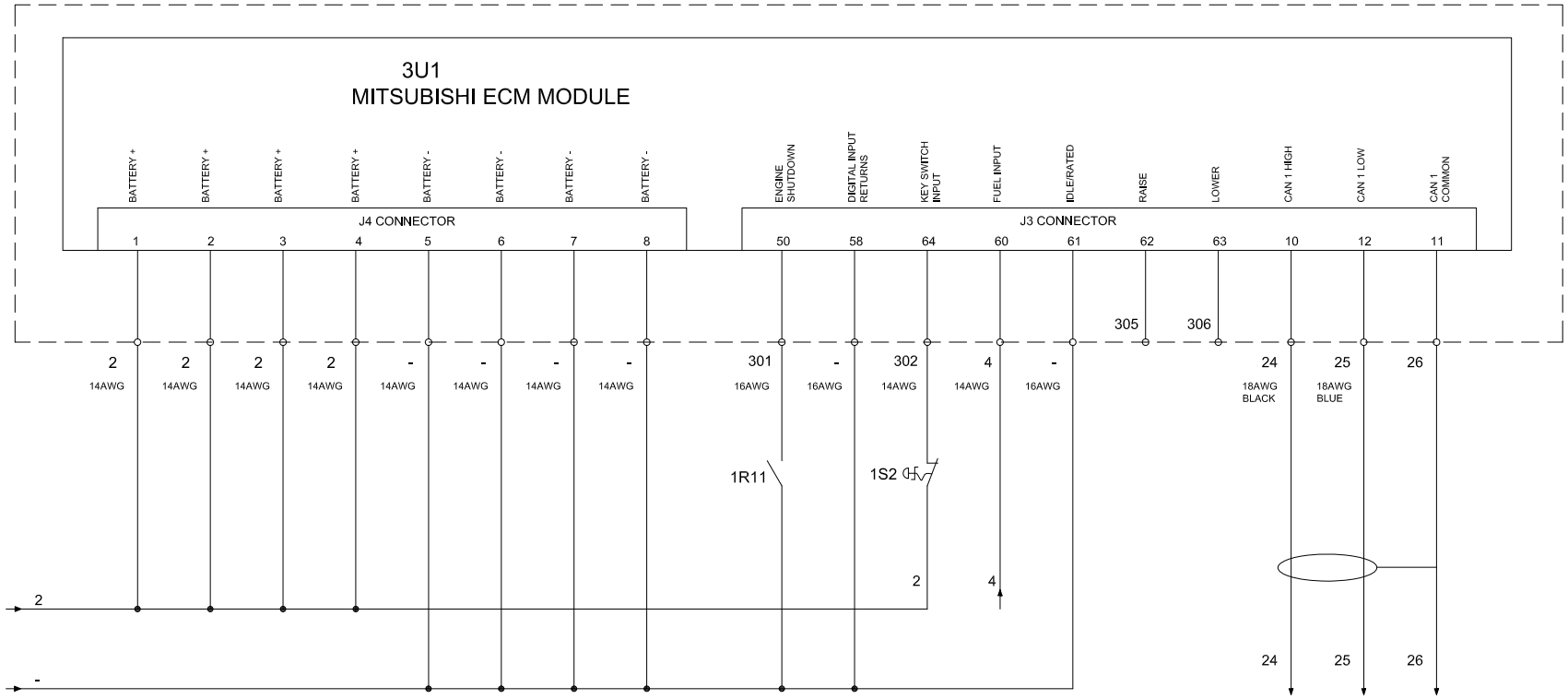

| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: | WEIGHT: |
|---|---|---|---|---|
| | 2017 DATE NAME SIGNITURE | PART NAME: START PANEL | | |
| | DRAWINGED BY 02.05 HELEN | USED FOR: APD-ULM1000(Mitsubishi S12H DSE7320MKII WITH ANTI-CON/9KW WATER HEATER) | | |
| | CONTROLED BY 02.05 TOM | | | |
| | APPROVED BY 02.05 TOTO | PART NO.: | LOCATION: A4 | |
| | DEPARTMENT: ENGINEERING | DRAWING NO.: SP.M2362084UL | | PAGE 1-4 |
| A Change water heater circuit 2017.02.05 HELEN | aksa POWER GENERATION | REVISION NO.: 01 | | |
| SIGN VARIATION DATE NAME | | ONLY ENGINEERING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. | | |

# AUTOMATIK TRANSFER PANOSU
# AUTOMATIC TRANSFER SWITCH






| | | | |
|---|---|---|---|
| ORDER CODE: | SCALE: 1:1 | MATERIAL: | QUANTITY: / WEIGHT: |
| | 2017 DATE / NAME / SIGNITURE | PART NAME: START PANEL | |
| | DRAWINGED BY 02.05 HELEN | USED FOR: APD-ULM1000(Mitsubishi S12H DSE7320MKII WITH ANTI-CON/9KW WATER HEATER) | |
| | CONTROLED BY 02.05 TOM | | |
| | APPROVED BY 02.05 TOTO | | |
| | DEPARTMENT: ENGINEERING | PART NO.: | LOCATION: A4 |
| A Change water heater circuit 2017.02.05 HELEN | aksa POWER GENERATION | DRAWING NO.: SP.M2362084UL | PAGE 2-4 |
| SIGN VARIATION DATE NAME | | REVISION NO.: 01 | ONLY ENGINEERING DEPT. OF AKSA COMP. HAS RIGHT TO KEEP AND MODIFY IT. IT CAN NOT BE SUPPLIED OR COPIED TO THE 3TH ORGANIZATION. |






| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| A | Change water heater circuit | 2017.02.05 | HELEN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| DRAWINGED BY | 02.05 | HELEN | |
| CONTROLED BY | 02.05 | TOM | |
| APPROVED BY | 02.05 | TOTO | |

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

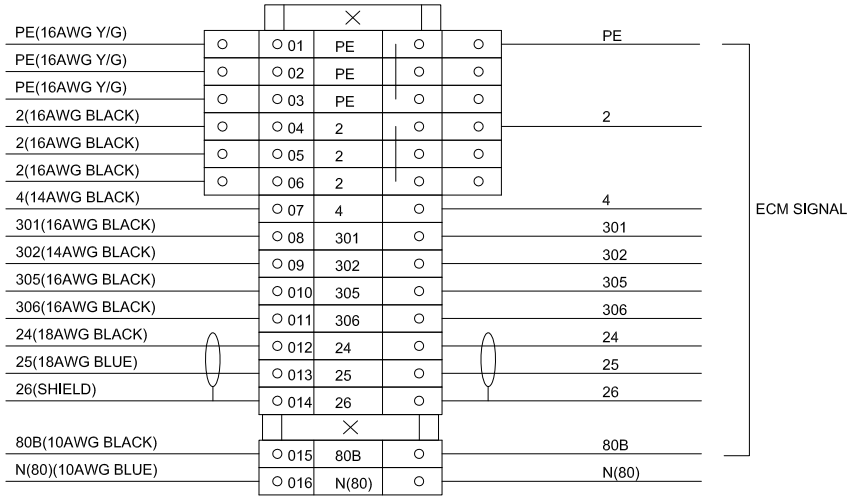
PART NAME: START PANEL

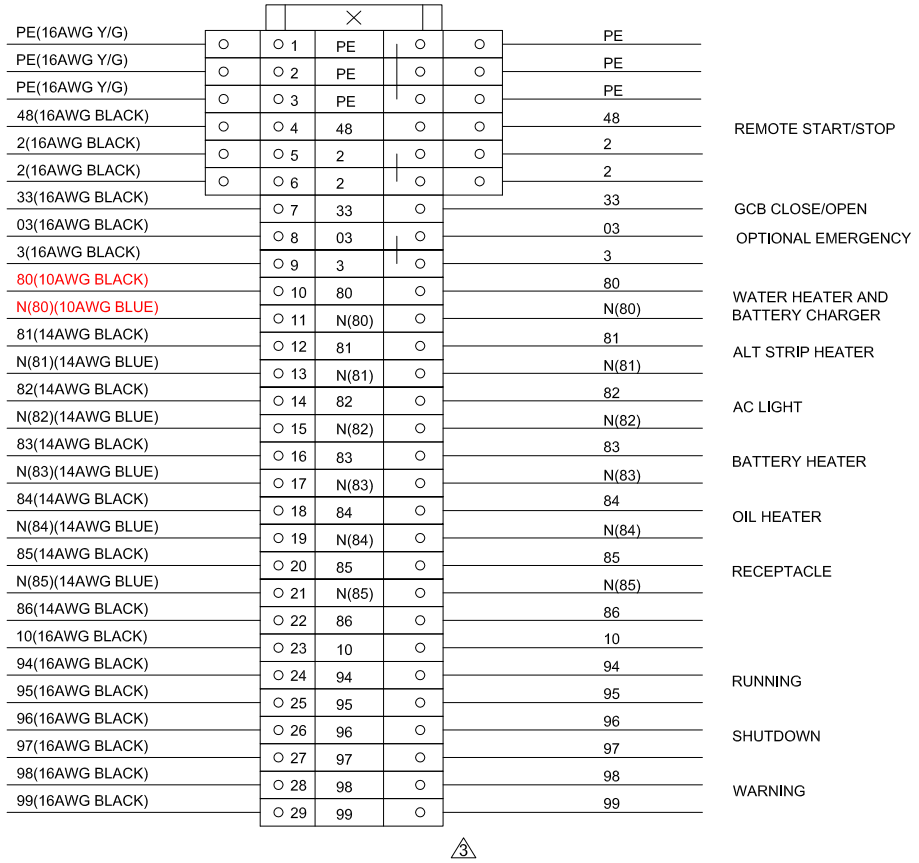
USED FOR: APD-ULM1000(Mitsubishi S12H DSE7320MKII WITH ANTI-CON/9KW WATER HEATER)

PART NO.: | LOCATION: A4 | PAGE 3-4

DRAWING NO.: SP.M2362084UL

REVISION NO.: 01






| ITEM | PART NO. | ITEM DESCRIPTION | UL REQUIREMENT |
|---|---|---|---|
| 24 | 2H1 | WATER HEATER UL | |
| 23 | 2CT1 | CURRENT TRANSFORMER UL | UL Approved (ANSI/IEEEC57.13) |
| 22 | 2T2 | TYCO 4HOLE 1-480703-0 | UL 1977 |
| 21 | 2T1 | TYCO 9HOLE 1-480707-0 | UL 1977 |
| 20 | 1T2 | TYCO 6HOLE 1-480705-0 | UL 1977 |
| 19 | 1T1 | TYCO 15HOLE 1-480711-0 | UL 1977 |
| 18 | 1F4,2F2,2F3,2F4 | 216002P/F2.0A 250V 5x20(FUSE) | UL 248 |
| 17 | 2F5,2F8 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 16 | 2F1 | ABB S202U K40A-2P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 15 | 1F3 | ABB S201U K16A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 14 | 1F2 | ABB S201U K32A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 13 | 1F1 | ABB S201U K6A-1P(HIGH BREAKER MINI CURRENT CIRCUIT) | UL 489 |
| 12 | 2F6,2F7 | 2163.15P/F3.15A 250V 5x20(FUSE) | UL 248 |
| 11 | 1U2 | DEEPSEA7320MKII MODUEL | UL 508 |
| 10 | 1U1 | BATTERY CHARGE AC230V/DC24V | UL 1236 |
| 09 | 1L1 | CANOPY LIGHT PD771WRR DC12V | |
| 08 | 1S7 | LOW WATER LEVEL SWITCH | |
| 07 | 1S6 | FEXIBLE SENSOR | |
| 06 | 1S5 | WATER TEMP. SENSOR | |
| 05 | 1S4 | OIL PRESS SENSOR | |
| 04 | 1S2 | EMERGENCY STOP ABB UL | UL 94 |
| 03 | 1S1 | CANOPY LIGHT SWITCH | |
| 02 | 1R1,1R2 | ROCKWELL 700-HHF62Z24/SCHNEIDER 389FXBXC1-24D DC24V 25A | UL 508 |
| 01 | 1R8,1R9,1R11 | DRM270024LT(RELAY)AND RELAY N.C CONTACTOR | UL 508 |

△1 :Canopy Gen-set do not install emergency stop 1S2 button in start panel.1S21 is optional emergency stop.

△2 :For all Aksa USA UL gensets are using two wire start off of digital input48 to start the genset up.

△3 :1~6,01-06#Terminal model:Weidmuller ZDU 2.5/4AN UL(UL1059);7~9,12~29,08-014#Terminal model:Weidmuller ZDU2.5 UL(UL1059).
10~11,015-016#Terminal model:Weidmuller ZDU10 UL(UL1059).

| SIGN | VARIATION | DATE | NAME |
|---|---|---|---|
| A | Change water heater circuit | 2017.02.05 | HELEN |

ORDER CODE:

SCALE: 1:1

| | DATE | NAME | SIGNITURE |
|---|---|---|---|
| DRAWINGED BY | 02.05 | HELEN | |
| CONTROLED BY | 02.05 | TOM | |
| APPROVED BY | 02.05 | TOTO | |

2017

DEPARTMENT: ENGINEERING

aksa POWER GENERATION

MATERIAL: | QUANTITY: | WEIGHT:

PART NAME: START PANEL

USED FOR: APD-ULM1000(Mitsubishi S12H DSE7320MKII WITH ANTI-CON/9KW WATER HEATER)

PART NO.: | LOCATION: | A4 | PAGE 4-4

DRAWING NO.: SP.M2362084UL

REVISION NO.: 01