December 2016
EM005761-2 (EN-US)

Operation and Maintenance Manual

MD6420 Rotary Blasthole Drill

DS7 1-Up

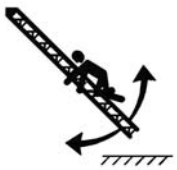
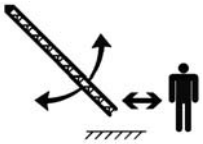
DT7 1-Up

DT9 1-Up

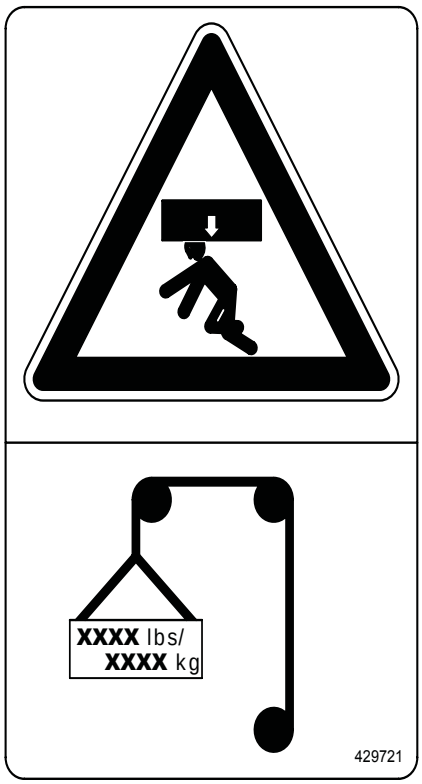
DN9 1-Up

DR4 1-Up

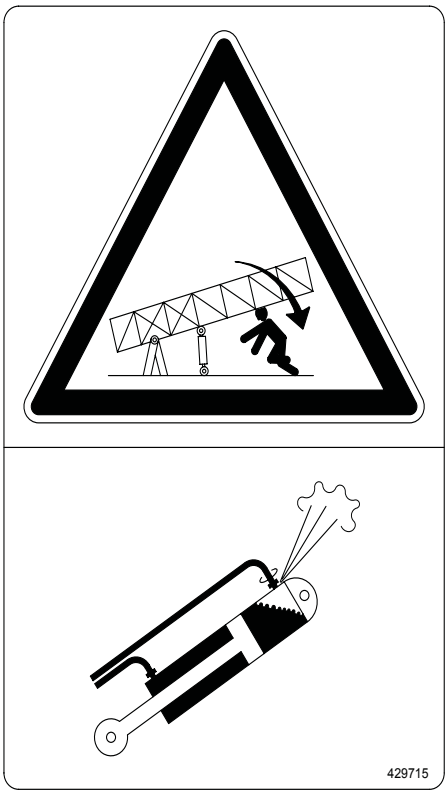
Overview of Potential Hazards

Potential Hazard		Prevention	
	**Explosion / Burn Hazard.** Can cause death, burns or blindness due to ignition of explosive gases or contact with corrosive acid.		Keep all open f ames and sparks away. Wear personal protective equipment, including face shield, gloves and long sleeve shirt. **READ MANUALS** Read all manuals prior to operation. DO NOT OPERATE equipment if you do not understand the information in the manuals. Consult your supervisor, the owner or the manufacturer.
	**Explosion Hazard**. Combustible gas can cause severe injury or death.		Do not spray "High Energy" starting aid into compressor air inlet or engine grid heaters.
	**Fall Hazard.** Death or serious injury can result from falling.		Use the access system provided when servicing the machine.
	**Crush Hazard.** Standing on stairway when raising or lowering can cause severe injury or death.		Keep clear of moving stairway.
	**Electrical Shock Hazard.** Can cause severe injury or death.	Disconnect battery prior to electrical system service work or any welding to avoid electrical shock and machine damage. Refer to service operator manual.	

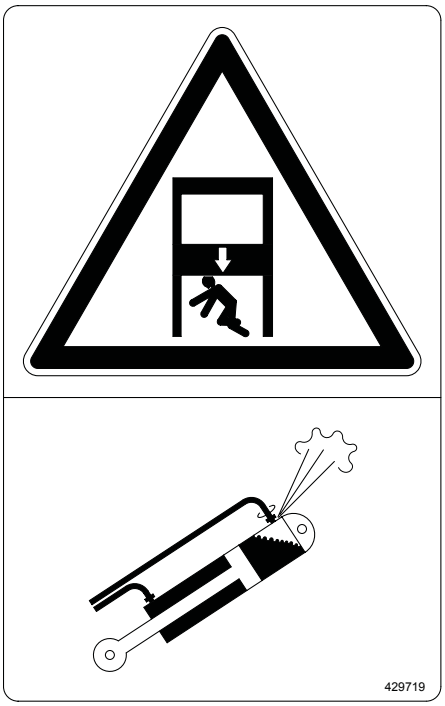
Crush Hazard–Carousel (429718)



Crush Hazard–Winch (429721)



Crush Hazard–Mast (429715)



Crush Hazard–Rotary Head (429719)

Compressor

Compressor (Standard)	
Type	Oil-flooded, single-stage screw
Discharge air flow (sea level)	56.6 m^3/min (2,000 cfm)
Max operating pressure	6.9 bar (100 psi)
Air cleaner Type Model	 Dry-type with safety element SRG 20
Oil cooling	Air-to-oil cooler, thermostatically controlled
Oil separation	Vertical barrier element, pre-separation in 167 l (44 gal) sump, vertical tank
Oil filtratio	12 micron replaceable element
Drive	Direct coupled to engine flywhee
Controls	Automatic with safety shut-down
Air shut-off	Hydraulic cylinder-operated from operator's seat

Compressor (Optional)	
Type	Oil-flooded, single-stage screw
Discharge air flow (sea level)	67.9 m^3/min (2,400 cfm)
Max operating pressure	6.9 bar (100 psi)
Air cleaner Type Model	 Dry-type with safety element SRG 29
Oil cooling	Air-to-oil cooler, thermostatically controlled
Oil separation	Vertical barrier element, pre-separation in 167 l (44 gal) sump, vertical tank
Oil filtratio	12 micron replaceable element
Drive	Direct coupled to engine flywhee
Controls	Automatic with safety shut-down
Air shut-off	Hydraulic cylinder-operated from operator's seat

Compressor (Optional)	
Type (high-pressure)	Oil-flooded, two-stage screw
Discharge air flow (sea level)	42.5 m^3/min (1,500 cfm)
Oil separation	Vertical barrier element, pre-separation in 189 l (50 gal) horizontal sump (T-tank)
Maximum operating pressure	10.3/24.1 bar (150/350 psi)

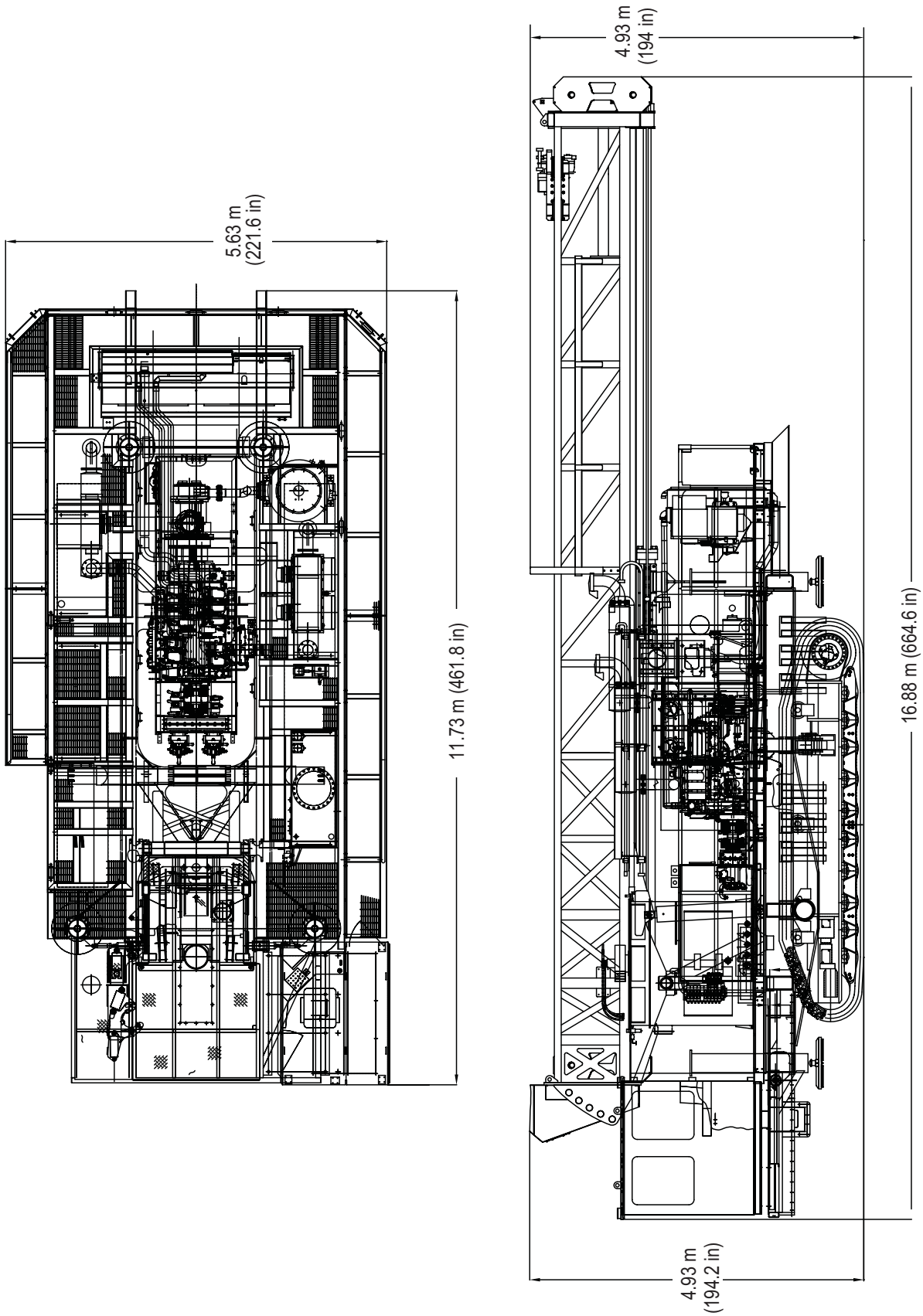
Compressor (Optional)	
Type (high-pressure)	Oil-flooded, two-stage screw
Discharge air flow (sea level)	42.5 m^3/min (1,500 cfm)
Oil separation	Vertical barrier element, pre-separation in 189 l (50 gal) horizontal sump (T-tank)
Maximum operating pressure	10.3/24.1/34.4 bar (150/350/500 psi)

Engine

Engine (Standard)	
Manufacturer	Caterpillar®
Model	C27 Tier II
Rated horsepower	597 kW (800 hp)
Full load	2,100 rpm
Starting system	24 V DC
Safety shut-down system	Energized to run
Air cleaner Type Model	 Dry-type with safety element SRG 20
Batteries	Four (4) 8-D
Muffle	127 mm (5 in) inlet and outlet
Muffler gua d	10 ga. for personal protection
Fuel tank	1,514 l (400 gal), optional 1,703 l (450 gal)
Turbo and manifold covers	Blankets and/or exhaust wrap

Engine (Optional)	
Manufacturer	Cummins
Model	QST-30
Rated horsepower	(Tier I) 634 and 783 kW (850 and 1,050 hp) (Tier II) 672 and 783 kW (900 and 1,050 hp)
Full-load	2,100 rpm
Starting system	24 V DC
Safety shut-down system	Energized to run
Air cleaner Type Model	 Dry-type with safety element SRG 29
Batteries	Four (4) 8-D
Muffle	127 mm (5 in) inlet and outlet
Jacket water cooling and/or CAC	
Fuel tank	1,514 l (400 gal), optional 1,703 l (450 gal)
Turbo and manifold covers	Blankets and/or exhaust wrap

SKS-W Dimensions



Section 3

Operator Controls

41. Not Used

42. Drill Pipe Loader–Swing

This switch is used to swing the drill pipe loader out from and into the center of the mast when adding and retracting drill pipe and for storing the drill pipe loader when propelling or lowering the mast.

43. Water Injection/Dust Collector

This switch is used to engage the water injection or dust collector systems to control drilling dust.

- Push switch up to engage water injection system.
- Push switch down to engage dust collector system.

44. Hydraulically Operated Break-Out Wrench (HOBO)–Swing

The break-out wrench is used to undo tight thread connections. This switch is used to swing the break-out wrench into or away from the drill pipe.

- Push and hold switch up to swing break-out wrench out.
- Push and hold switch down to swing break-out wrench in.

45. Drill Pipe Support

The drill pipe support is used to support the drill pipe in the center of the mast when using the drill pipe loader for multiple pass drilling.

- Push and hold switch up to engage drill pipe support. Red light will come on.
- Push and hold switch down to disengage drill pipe support. Red light will go out.

46. Hydraulically Operated Break-Out Wrench (HOBO)–Clamp

The break-out wrench is used to undo tight thread connections. This switch is used to clamp and unclamp the break-out wrench and to turn the wrench.

- Push and hold switch right to disengage (open) break-out and unclamp wrench.
- Push and hold switch left to clamp wrench and engage (close) break-out.

47. Remote Tram (optional)

When switch is toward pendant symbol, machine can be trammed using remote pendant control.

48. Viewing Hatch

Push switch DOWN to open viewing hatch. Push switch UP to close viewing hatch.

49. Drill Stem Thread Lube (optional)

Push and hold switch down to activate grease pump to lubricate drill pipe threads.

50. Dust Curtain

Switch is used to raise or lower the dust curtain at the rear of the machine.

- Push and hold switch up to lift dust curtain.
- Push and hold switch down to lower dust curtain.

51. Air Line Lubricator (high pressure machines)

Push switch down to activate lubricator pump to provide lubrication for "In The Hole Hammers".

Maintenance and Servicing Schedule

	Daily Service	Weekly Service	Monthly Service	Every 3 Months	Every 6 Months	Yearly Service
Check Liquid Receiver/Drier 1. Refrigerant lines & connections 2. Securing bolts 3. For possible need of replacement 4. For refrigerant leakage 5. Sight glass during operation				X	X	X
Check High Pressure & Low Pressure Controls 1. For correct setting 2. Securing screws tightness 3. Electrical connections				X	X	X
Check Securing Fasteners on Fresh Air and Return Air Filters				X	X	X
Check Evaporator Coil 1. For cleanliness 2. For refrigerant leakage 3. For tightness of securing screws			X	X	X	
Check Evaporator Fan Motor 1. For tightness of securing screws 2. For electrical connections				X	X	X
Check Evaporator Blower 1. For tightness 2. For damaged blades 3. For excessive noise during operation				X	X	X
Check Against Refrigerant Leakage of the Thermal Expansion Valve			X	X	X	
Check Electrical Connections of Thermostat				X	X	X
Check Control Switch 1. Electrical connections 2. Operation				X	X	X
Check Heater Control Valve 1. For water leakage 2. Tightness of securing screws 3. Operation				X	X	X
Check for Damage and Cleanliness of Louvers				X	X	X

Walk Around Inspection (cont.)

Mast

- Mast cap bolts

If mast cap bolts are missing or appear loose, the drill must not be used until checked by authorized person.

- Check pipe safety arm is closed and locked
- Rope condition and tension
- Check retaining plate in top of carousel for damage
- Check bull hose whips check in place
- Check rotary head guides, loose bolts missing slides
- Check rotary head for oil leaks
- Check mast crown for damage
- Check carousel indexing cylinders pins
- Check lubrication of all pivot points
- Check mast grates for loose or missing bolts

On Deck Checks

- Hydraulic system condition and leaks
- Engine condition and leaks
- Compressor condition and leaks
- Cooler pack for leaks, damage and cleanliness
- Dust collector
- Ensure guards and covers are in place and secure
- Structural integrity
- Fire suppression and extinguishers are charged and within service date
- Drain water from control air manifold and water traps

Fire Extinguishers

Fire extinguishers shall comply with EN79:1995 paragraph 5.12.2 and EN 3:1975. Each f re extinguisher shall have an agent with a mass of not less than 13.2 lbs (6 kg). Fire extinguishers shall be suitable for extinguishing both oil and electrical f res. As part of pre-start checks, check that f re extinguishers are fully charged.

In order for an operator to be sure his drill is ready for operation at any time, a regular program of preventive maintenance should be adopted. It is recommended that such a maintenance program be established on the basis of the operator and/or maintenance personnel performing specif c maintenance work during various periods of equipment operations, at intervals during which the equipment will be idle, and during extended periods of time when the equipment will be in storage.

When the drill is in continual, daily use, it is further recommended that a program of daily service requirements be established with preventive maintenance being performed on a "before operation", "during operation", and "after operation" schedule.

NOTE **For additional preventive maintenance information, refer to vendor manuals provided in the drill Service Manual.**

Hydraulic System Maintenance

The hydraulic components of the drill are built for many years of trouble-free operation. Only one preventive maintenance step is necessary to ensure the expected life of the system—CLEANLINESS.

When dirty f lters are indicated, change the f lter as follows:

- Clean the area around the f lter covers to prevent dirt entering the f lter housings.
- Pull f lters from the housings. Install new f lter and install the covers making sure the cover O-ring is in place.

Sight gauges are provided on the sides of the tank for checking oil levels.

- Oil level should be at the halfway point of the sight gauge when all cylinders are extended.
- A temperature gauge is also provided on the sight gauge.

CLEANLINESS cannot be overstressed:

- Use new oil only from previously unopened containers.
- Clean all tank openings.
- Fill tank through return f lter.

Fig. 4-8 Hydraulic Tank Oil Level and Temperature Gauge

Fig. 4-9 Hydraulic Loop Filter–Two f lters mounted on each side of mast "A" frame.

Fig. 4-10 Hydraulic Pump Charge Filter–One f lter mounted on each side of pump drive.

Start-Up Procedure

Before starting the machine, warn nearby members of the work crew that you are starting the machine. DO NOT USE ETHER on engines equipped with air inlet heaters.

To Start Engine:

1. Be sure all controls are in the Off or Neutral position.
2. Place the air control valve (10) or air control switch (39) in the start position for low pressure systems or low for high pressure systems. Some machines, use switch (39) in place of valve (10).
3. Place throttle lever (2) in low position.
4. Turn the ignition key (15) on.
5. Push and hold the engine start button (16) until the engine starts, when engine is started, release start button. The engine pre-lube pump will operate for a few seconds before the starter cranks the engine. Do not crank engine for more than 30 seconds, then allow starter to cool for two minutes before attempting to start again.
6. If it is necessary to use the optional ether injection (17) for starting, use caution not to use too much as engine damage can occur. Press button for 3 seconds and release, then allow 3 seconds before starting engine. DO NOT USE ETHER on engines equipped with air inlet heaters.

   DO NOT SPRAY ETHER into compressor inlet.

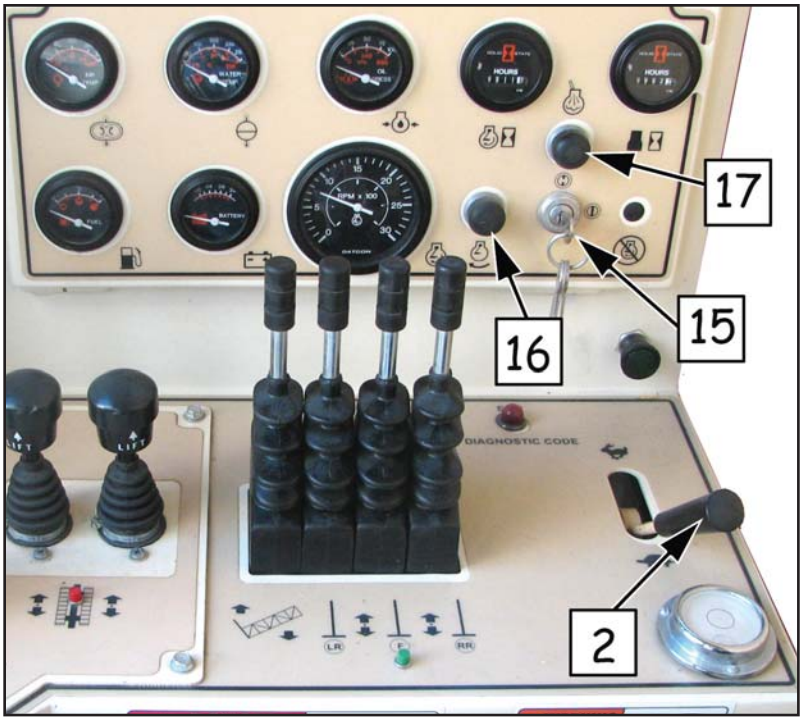


Fig. 5-4 Operator's Control Panel–Right Side

Raising Mast

LOOK UP before raising or lowering mast. Operating near, or coming in contact with electrical power lines will result in serious personal injury or death.
Refer to the Clearances from High Voltage Lines chart below.

ALWAYS check that the deck area is clear of dirt and obstructions before raising the mast.

ALWAYS level machine before raising or lowering mast and before drilling. Make sure tracks are always raised from the ground.

Clearances from High Voltage Lines	
Line Voltage	**Minimum Clearance**
0 to 50 kv	10 ft (3 m)
50 to 200 kv	15 ft (4.6 m)
200 to 350 kv	20 ft (6.1 m)
350 to 500 kv	25 ft (7.6 m)
500 to 750 kv	35 ft (10.7 m)
750 to 1000 kv	45 ft (13.7 m)

1. Level the machine, using the Leveling Machine procedure previously outlined.
2. Check mast for loose drilling tools or parts.
3. Be sure mast lock pins are retracted and drill bit will clear work deck area.
4. Look up before raising mast. Be sure you are clear of any overhead obstructions and clear of any power lines. Raise mast by engaging the mast lever to the RAISE position. The mast should start to lift; if not, check the auxiliary hydraulic pressure gauge to see if any other functions are engaged.
5. As the mast approaches the vertical position, the mast raising speed will tend to increase. It is necessary to slow the speed to stop the mast from hitting into the base of the machine too hard.
6. The mast angle may be set from 60º to the vertical depending on drilling applications. Use the angle indicator on the mast to set the correct angles.
7. Once the mast has been set at the desired angle, lock the mast into position by switching the Mast Lock/Unlock switch to the LOCK position.

NOTE **Be sure to visually check to see that mast locking pins are fully engaged in the holes in the mast lock brackets before drilling. Also be sure that the pins are fully retracted before lowering the mast. Red or green LED indicators should also conf rm the visual check, when equipped.**

Cold Weather Operation

Maintenance

BE SURE there are no fuel leaks near the burner unit.

DISCONNECT BATTERY or unplug cable to heater controller before doing any welding on machine. Damage to controller unit will result.
Allow time for burner unit to cool before doing any repair work.

Heater/Pump Unit–Maintenance and Repair

Refer to the Espar repair manual for the Hydronic 30 compact heater in Section 10 of the Service Manual. Order repair parts from Parts Manual for your specif c machine.

Cooling System Freeze Protection

In the late fall, before temperatures drop below 32°F. (0°C), the complete cooling system should be drained and f ushed. The thermostat should be removed during f ushing. Check for proper operation or replace before reinstalling. When ref lling, add a suff cient amount of anti-freeze for your climate. A 50/50 mixture is recommended for maximum protection

Water Injection System Freeze Protection

To blow water out of the lines and pump before shutting machine down, the following steps need to be done with the machine in idle mode.

1. Turn the optional handle on the cab side crawler frame to open ball valve to drain water tank. After water tank is drained, leave ball valve on bottom of water tank open until time to add water to tank, then close valve.
2. After water tank is drained, open shut off valve on top of air receiver to release air into water system. With the water injection switch in the cab in OFF position, this will blow water through the pump and back to the tank. After 5 seconds, switch the water injection switch to ON. This will blow water into the main air line.
3. Turn main air ON to blow water out of standpipe and drill pipe. Let run for about 15 seconds. At this time all water is out of lines and pump.
4. Shut machine down. While the machine's air receiver is in blowdown mode, leave shut off valve on top of air receiver open to blow into water injection system.
5. After air receiver has blown down, close shut off valve on top of air receiver to close line.
6. Before starting machine, prime the water pump by pouring water into the pipe nipple on suction side of pump inlet.

Receiver Tank

Drain water from the receiver tank daily or whenever the machine is shut down for more than one hour.

NOTE **BE SURE to evacuate all the remaining water from the water injection pump to prevent the pump from freezing.**

Drill Bit Stabilizers

Drill bit stabilizers are used to reduce possible hole def ection and to ensure that the drill bit runs concentrically (evenly in the center of the hole) about its axis and thereby optimizes bit life and penetration rates.

There are two main types of stabilizers available, blade and roller. Blade stabilizers have f xed wings that have been either hard faced or mounted with tungsten carbide inserts. Roller stabilizers are mounted with replaceable rollers which are built up with a special tungsten carbide weld and held in place by long lasting non grease bearings.

Advantages of Blade Type Stabilizers

1. Generally cheaper.
2. May use replaceable wear bars for rapid rebuilding.
3. Can use replaceable sleeves.

Disadvantages of Blade Type Stabilizers

1. Require rebuilding for each new drill bit.
2. Have relatively high torque requirements.
3. In hard ground they may provide little stabilization after the f rst couple of holes.

Advantages of Roller Type Stabilizers

1. Lower torque requirements than blades.
2. Better stabilization.
3. Generally give more economical life.
4. Throw away or replaceable rollers.

Disadvantages of Roller Type Stabilizers

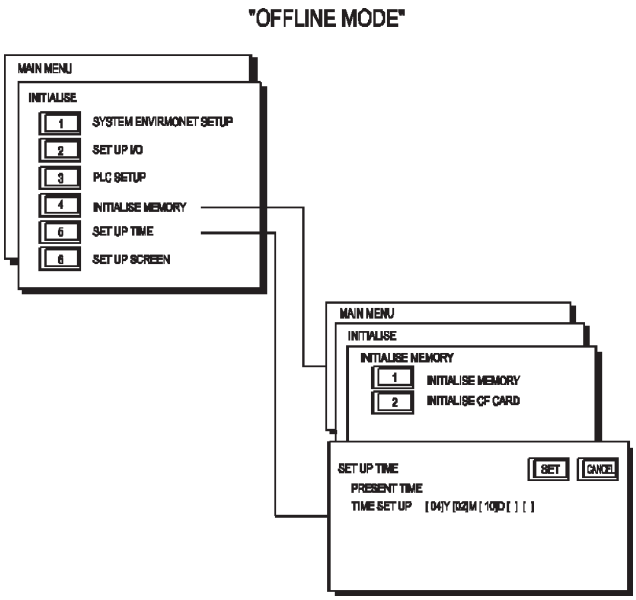
1. High purchase cost.
2. Expensive replacement of parts.

Touchscreen

Setting Date & Time

To access the ‘OFF LINE’ mode. Simultaneously touch all four corners of the screen and then select’ OFF LINE’ from the displayed buttons. Now at the ‘MAIN MENU’ select ‘INITIALISE’.

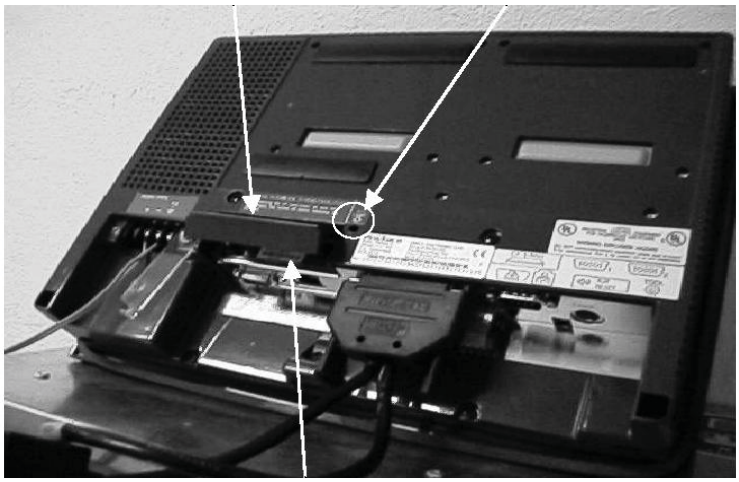
Once the Time and Date are set, return to the ‘MAIN MENU’ and select ‘RUN’ mode



Changing a CF Card

PROGRAMME DOWNLOAD PROCEEDURE

1. Gain access to the rear of the touchscreen. Remove the screen and or mounting.
2. Open the CF card cover. Green LED



3. Slide the CF card into the slot, label side up, and close the cover.
4. At the front of the touchscreen. Touch all four corners of the screen simultaneously, select ‘OFF LINE’.
5. At the MAIN MENU select ‘2’ Screen Data Transfer.
6. At the Screen Data Transfer menu select ‘3’ Copy From CF Card.
7. Enter the password 1101 and START.
8. Down load procedure now starts. Takes approx 5 min.
9. Once complete select the main menu by touching MAIN MENU on the screen.
10. At the MAIN MENU select ‘4’ RUN to place the touchscreen into ‘run mode’.
11. Open the CF Card cover – waiting for the green LED to go out indicating it is safe to remove the CF Card.
12. Remove the card, close the cover, and resecure the touchscreen / mounting.
13. Procedure is complete.

Setting Brightness

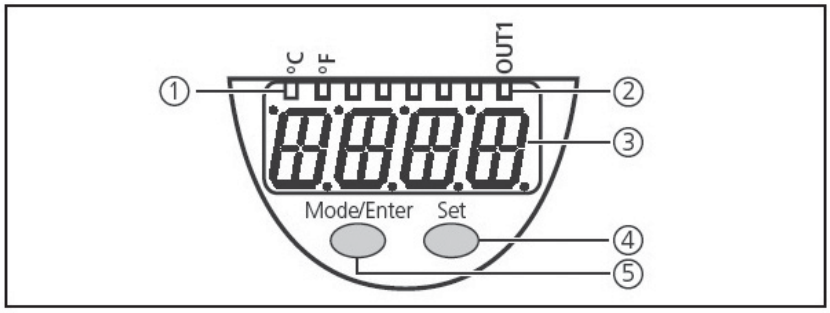
To adjust the brightness of the Touchscreen, Simultaneously touch both bottom corners of the screen and then use the slider to adjust the brightness. Touch anywhere else on the screen to return to the run mode.

Temperature Transducer

Error code table for error codes as seen on transmitter display

OL	Above measuring range by more than 3% of the maximum value.
UL	Below measuring range by more than 10% of the minimum value.
SC I	Flashing: Short-circuit in the switching output (OUT 1). the output is switched off as long as the short circuit continues.
Err	Flashing: No temperature sensor connected, fault or short circuit in the temperature sensor, wire break, evaluable range (T < -60°C or T > +320°C) exceeded.

Controls and visual indication



①	2 x LED green	Lithning LED = set display unit.
②	LED yellow	Switching status; lights if the switching output has switched.
③	4-digit alphanumerical	Display of the system temperature, display of parameters and parameter values.
④	Set button	Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly).
⑤	Mode / Enter button	Selection of the parameters and acknowledgement of the parameter values.

When commissioning temperature sensor, complete following procedure **ONLY** after reading safety instructions supplied with sensor:

1. Press the **Mode/Enter** button several times until the **Mmod** (Fig.2) parameter is displayed (Fig.1).
2. Press the **Set** button (Fig.1) and keep it pressed. The current parameter value (3w, factory default setting, Fig.2) **f ashes** for 5 seconds. **Then** the value **is increased** (incremental by pressing brief y **or** scrolling by holding pressed).*
3. Press the **Mode/Enter** button **brief y** (= acknowledgement, Fig.1) when the 4w setting is displayed (Fig.2). The parameter is displayed again, and becomes effective.
4. To conclude, wait for 15 seconds before continuing.

   * – To decrease the value move the display of the parameter value to the maximum setting value, after which the cycle repeats from the minimum setting.
5. Using the above steps, repeat for the following parameter settings:

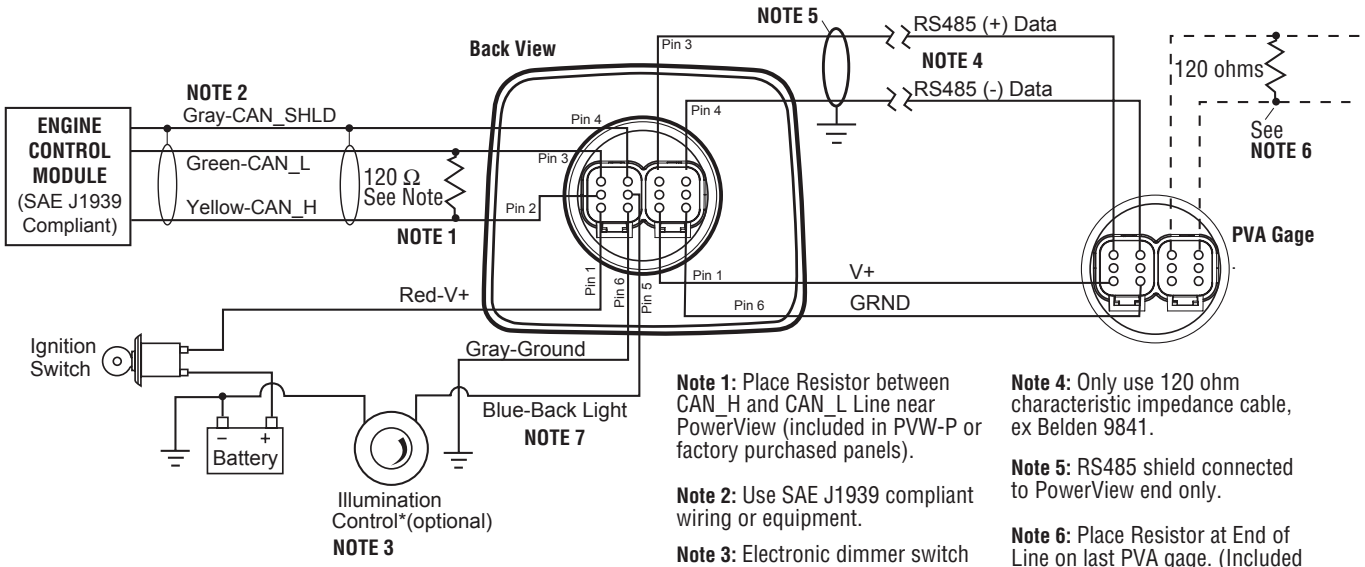
   a. **OU2:** set to ‘I’ (Fig.3).
   b. **ASP:** set to (-) 40 (Fig.4).
   c. **AEP:** set to (+) 150 (Fig.4).
   d. **FOU2:** set to ‘ON’ (Fig.5).

Engine Monitor (Murphy PowerView)

TYPICAL WIRING DIAGRAMS

IMPORTANT: To eliminate external interference: RS485(+) and RS485(-) should be twisted pair cable or twist wires together, one twist per inch minimum. CAN_L, CAN_H and CAN Shield should be approved J1939 CAN bus cable (CAN wire for example: RADOX plug and play cable, from Champlain cable). (RS485 wire for example: BELDEN 9841 or 3105A).

PowerView Deutsch DT06-6S Style Unit to PVA Gage



Note 1: Place Resistor between CAN_H and CAN_L Line near PowerView (included in PVW-P or factory purchased panels).

Note 2: Use SAE J1939 compliant wiring or equipment.

Note 3: Electronic dimmer switch recommended with 4A, capacity or heavy duty rheostat switch, 1000 ohm, 0.25 watt.

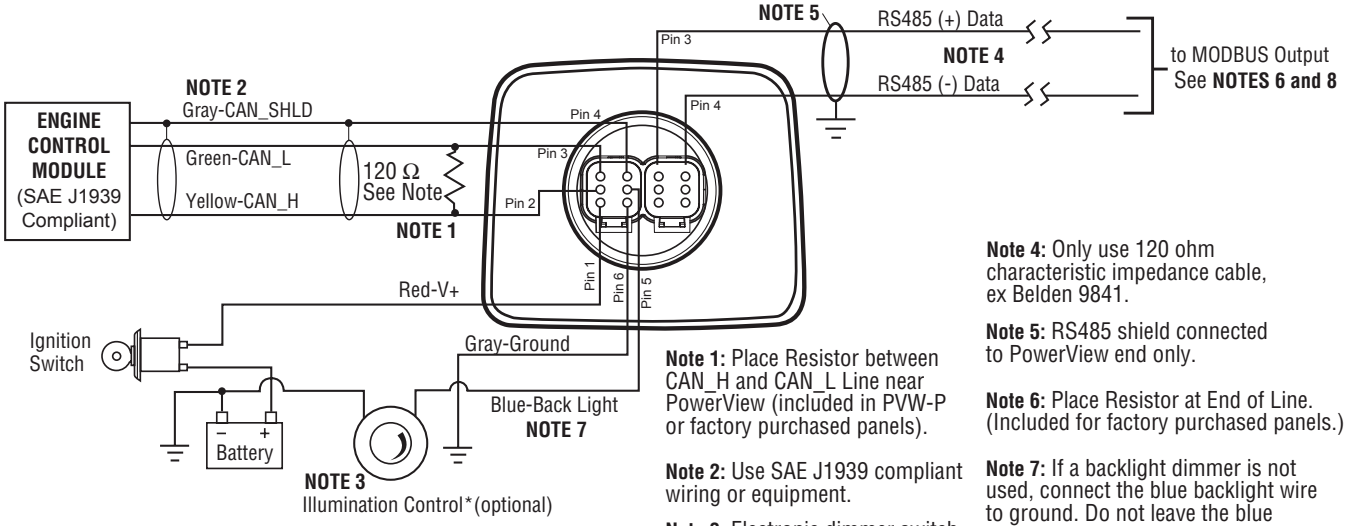
Note 4: Only use 120 ohm characteristic impedance cable, ex Belden 9841.

Note 5: RS485 shield connected to PowerView end only.

Note 6: Place Resistor at End of Line on last PVA gage. (Included for factory purchased panels.)

Note 7: If a backlight dimmer is not used, connect the blue backlight wire to ground. Do not leave the blue backlight wire unconnected.

PowerView Deutsch DT06-6S Style Unit to MODBUS Output



Note 1: Place Resistor between CAN_H and CAN_L Line near PowerView (included in PVW-P or factory purchased panels).

Note 2: Use SAE J1939 compliant wiring or equipment.

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Note 4: Only use 120 ohm characteristic impedance cable, ex Belden 9841.

Note 5: RS485 shield connected to PowerView end only.

Note 6: Place Resistor at End of Line. (Included for factory purchased panels.)

Note 7: If a backlight dimmer is not used, connect the blue backlight wire to ground. Do not leave the blue backlight wire unconnected.

Note 8: PVA gages cannot be used with the MODBUS feature.

For a complete listing of MODBUS Registers visit our website at www.fwmurphy.com