Doosan Infracore

COMPRESSOR TRAINING

Small compressors

Doosan Infracore Portable Power

SMALL COMPRESSORS RANGE

- 7/20 - P65 - 7 bar (100 PSI), 1.9 m3/min (70 cfm)
- 7/26E - P90 - 7 bar (100 PSI), 2.5 m3/min (90 cfm)
- 7/31E - P110 - 7 bar (100 PSI), 3.0 m3/min (105 cfm)
- 7/41 - P135 -7 bar (100 PSI), 4.0 m3/min (140 cfm)
- 7/51 - XP185 -7 bar (100 PSI), 5.0 m3/min (175 cfm)
- 7/71 - P260 -7 bar (100 PSI), 7.1 m3/min (250 cfm)
- 12/56 -12 bar (170 PSI), 5.6 m3/min (200 cfm)

Doosan Infracore Portable Power

SUMMARY

- The compressor can be divided in the following subsystems
  - ENGINE & AIREND
  - LUBRICATION & COOLING SYSTEM
  - AIR FLOW REGULATION SYSTEM
  - SEPARATION SYSTEM
  - BLOWDOWN SYSTEM
  - INSTRUMENT/CONTROL PANEL
  - ELECTRICAL WIRING
- Troubleshooting

Doosan Infracore Portable Power

ENGINE (7/20)

Compressor	7/20
IR Designation	3IRJ5N
Model	D 1005
Cylinders	3
Displacement	1 L
Rated Output (kW@RPM)	17.5@3000
Aspiration	Naturally aspirated
Fuel Pump	Mechanical inline pump
Emissions	Tier II certified
Electrics	12 Volts

ENGINE Tier 2 (7/26E – 7/51)

Compressor	7/26E	7/31E	7/41	7/51
IR Designation	3IRH2NS	3IRH8N	4IRH8N	4IRI8N
Model	3TNV82A	3TNV88	4TNV88	4TNV98
Cylinders	3	3	4	4
Displacement	1,3	1,6	2,2	3,3
Rated Output (kW@RPM)	21,1@2800	25,8@2800	34,8@2800	49,7@2400
Aspiration	Naturally aspirated			
Fuel Pump	Mono plunger mechanical pump			
Emissions	Tier II certified			
Electrics	12 Volts			

ENGINE Tier 3(7/51) from September 2008

Compressor	7/51
IR Designation	4IRI8NE-2
Model	4TNV98
Cylinders	4
Displacement	3,3
Rated Output (kW@RPM)	50.2@2400
Aspiration	Naturally aspirated
Fuel Pump	Mono plunger mechanical pump
Emissions	Tier III certified
Electrics	12 Volts

ENGINE Tier 2 (7/71 – 12/56)

Compressor	7/71 – 12/56
IR Designation	4IRD5N
Model	JD 4045DF270
Cylinders	4
Displacement	4.5 liter
Rated Output (kW@RPM)	60@2500
Aspiration	Naturally Aspirated
Fuel Pump	Rotary fuel pump
Emissions	Tier II certified
Electrics	12 Volts

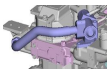
ENGINE Tier 3 (7/71 – 12/56) from October 2008

Compressor	7/71
IR Designation	4IRI8TE
Model	4TNV98T
Cylinders	4
Displacement	3,3
Rated Output (kW@RPM)	59.2@2300
Aspiration	Turbocharged
Fuel Pump	Mono plunger mechanical pump
Emissions	Tier III certified
Electrics	12 Volts

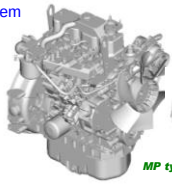
ENGINE Tier 3 Improvements – YANMAR ECO

Eco-Governor is Yanmar unique electronics control governor system which has been used for over 10 years mainly for agricultural machine. Yanmar has renewed this system to apply all equipment and named "2G Eco-Governor" which means second generation Eco-Governor. In addition, EGR valve for NV3 engine is controlled by this system.

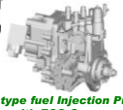
EGR Control system



EGR Valve



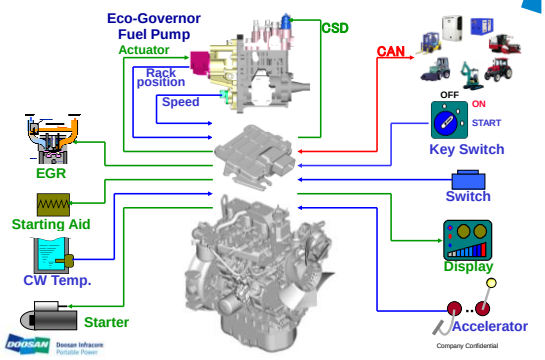
ECO-Governor system



MP type fuel Injection Pump with ECO Governor

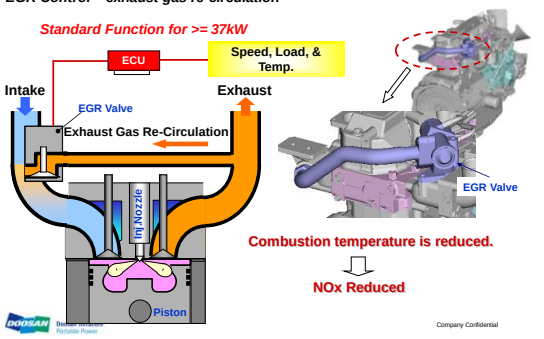
ECU

ENGINE Tier 3 Improvements – YANMAR ECO

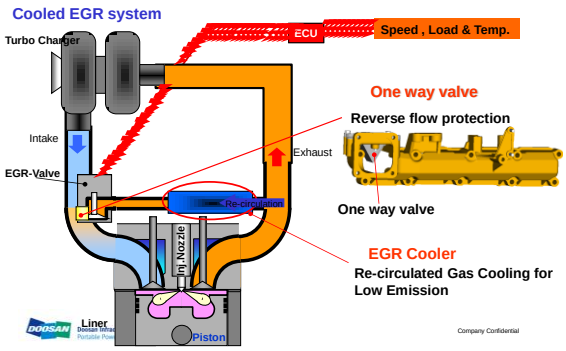


ENGINE Tier 3 Improvements – YANMAR ECO

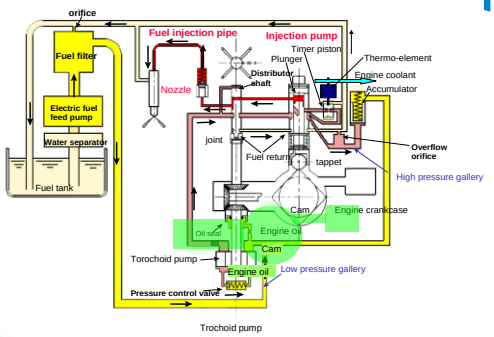
EGR Control – exhaust gas re-circulation



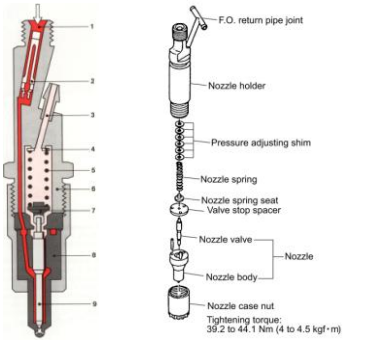
ENGINE Tier 3 Improvements – YANMAR ECO



ENGINE Tier 3 Improvements – YANMAR ECO



ENGINE Tier 3 Improvements – YANMAR ECO



AIREND

- Casing houses two screw-type rotors mounted on ball and roller bearings.
- Diesel engine drives the male rotor through heavy-duty coupling.
- Mechanical seal used to seal the shaft.
- Gear sets allow to change rotor speed and therefore air output.

AIREND (7/20)

- Now used on 7/20 only, formerly used on 7/21 and 7/26.
- Cast iron body.

AIREND (7/20)

- Now used on 7/20 only.
- Formerly used on 7/21 and 7/26.

AIREND (7/26E - 7/51)

- 85 mm Airend.
- Different gear sets permit to adjust air delivery.
- Cast aluminium body.
- Repair not advised.

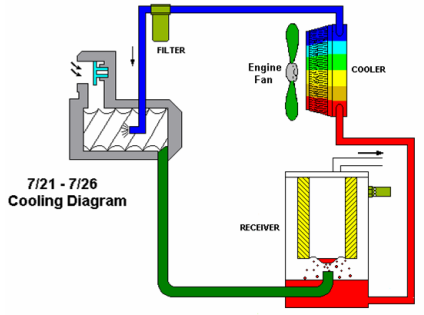
AIREND CF 90 (7/71 - 12/56)

- Different gear sets permit the use of this airend as 7/71 or 12/56.

COMPRESSOR OIL SYSTEM

- Functions of the oil system:
  - Lubricating the rotors, airend bearings and mechanical seals
  - Sealing the clearances between the airend rotors
  - Cooling of the airend. Heat is generated during air compression.
- The oil flows due to the air pressure. No oil pump is required.

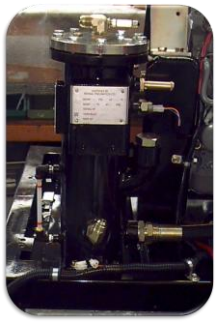
LUBRICATION & COOLING (7/20)



7/21 - 7/26
Cooling Diagram

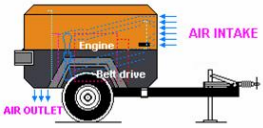
LUBRICATION & COOLING

- The Separator tank is also the reservoir of compressor oil.
- Pressure in the tank is forcing the oil through the system.

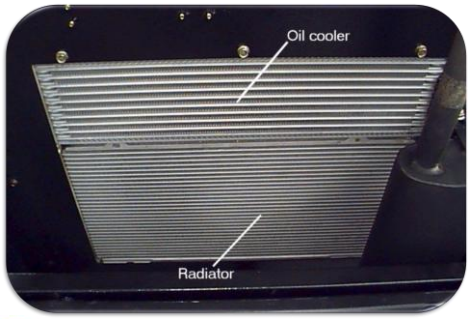


LUBRICATION & COOLING

- Cool box design with pusher type fan.



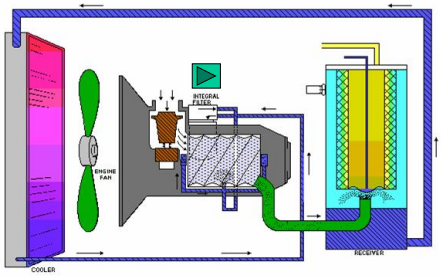
LUBRICATION & COOLING



LUBRICATION & COOLING

- Compressor oil filter, 10 micron rating.

LUBRICATION & COOLING (7/26E - 7/51)

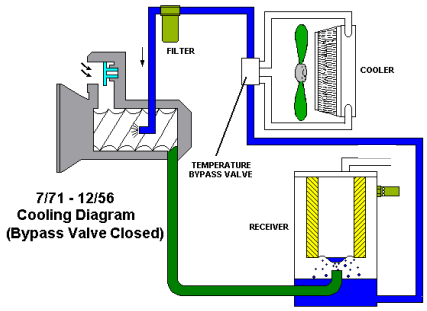


7/31 - 7/51
COOLING & LUBRICATION

LUBRICATION & COOLING (7/26E - 7/51)

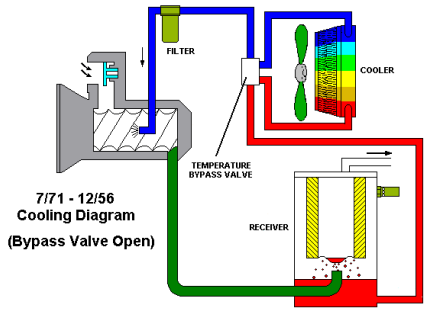
- Oil filter head integrated to airend.

LUBRICATION & COOLING (7/71 – 12/56)



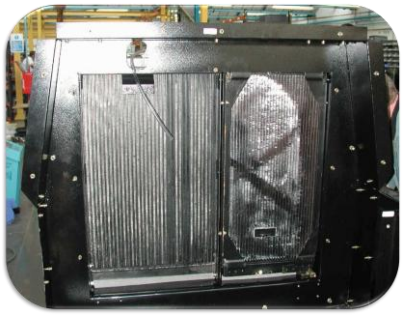
7/71 - 12/56
Cooling Diagram
(Bypass Valve Closed)

LUBRICATION & COOLING (7/71 – 12/56)



7/71 - 12/56
Cooling Diagram
(Bypass Valve Open)

LUBRICATION & COOLING (7/71 – 12/56)



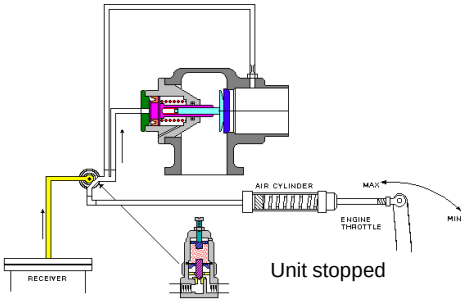
LUBRICATION & COOLING (7/71 – 12/56)

- Allows to regulate the oil temperature around 85°C.
- Keeping the oil hot enough allows to reduce the water condensation in the compressor.
- Never remove the thermostat as this would by-pass the oil cooler!

AIR REGULATION SYSTEM

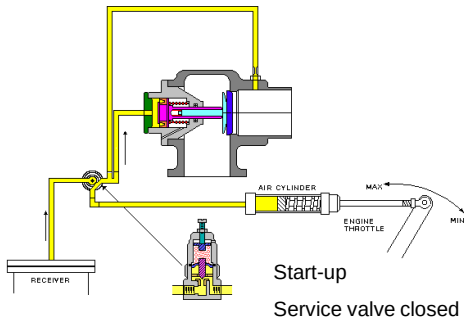
- The air regulation system continuously adjusts the production of compressed air to the consumption by controlling the engine speed and unloader valve.
- The unloader and fuel pump throttle are pneumatically (on mechanical engines) controlled through the pressure regulator.
- On the new electronic Yanmar engines the regulation pressure signal is converted to a speed signal to the engine ECU.

AIR FLOW & REGULATION (7/20)



Unit stopped

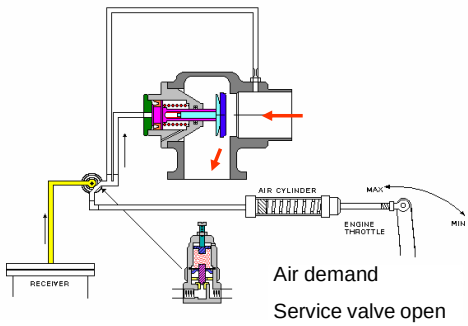
AIR FLOW & REGULATION (7/20)



Start-up

Service valve closed

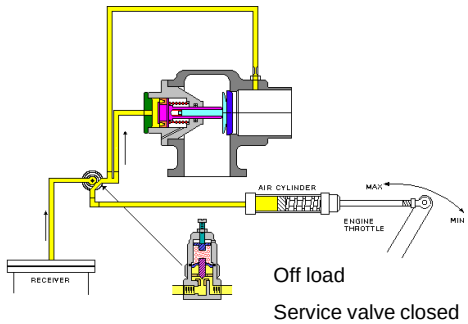
AIR FLOW & REGULATION (7/20)



Air demand

Service valve open

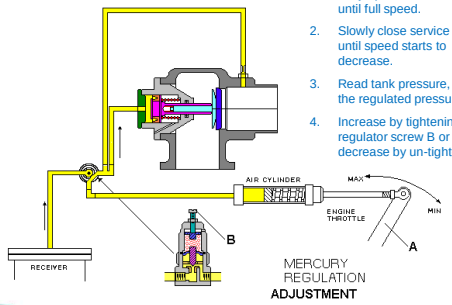
AIR FLOW & REGULATION (7/20)



Off load

Service valve closed

AIR FLOW & REGULATION (7/20)



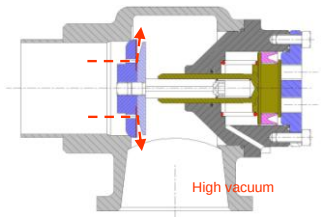
1. Fully open the service valve until full speed.
2. Slowly close service valve until speed starts to decrease.
3. Read tank pressure, this is the regulated pressure.
4. Increase by tightening regulator screw B or decrease by un-tightening.

AIR FLOW & REGULATION (7/20)

- Orifice continuously bleeds air from the regulation circuit.
- Size of orifice greatly affects regulation and can not be adjusted.

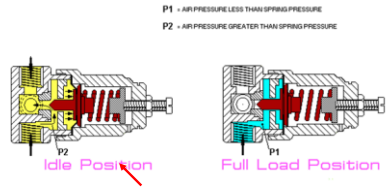
AIR FLOW & REGULATION (7/20)

- Anti-rumble valve.
- Membrane opens and allows some air to enter to limit vacuum at inlet.



REGULATOR VALVE - OPERATION

- Needle valve actuated by diaphragm and held closed by a spring.
- Controlled pressure preset in factory, can be adjusted by means of adjusting screw.
- Pin hole allows to determine diaphragm condition.

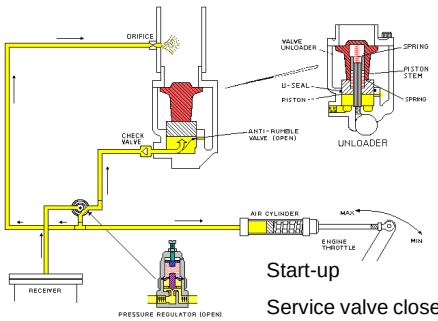


AIR FLOW & REGULATION (7/20)

- Mechanical engine - Spring loaded piston - Air pressure increase reduces speed.

- Electronic engine – Regulating pressure sensor sends signal to SECU which translates this to engine speed request to ECU.

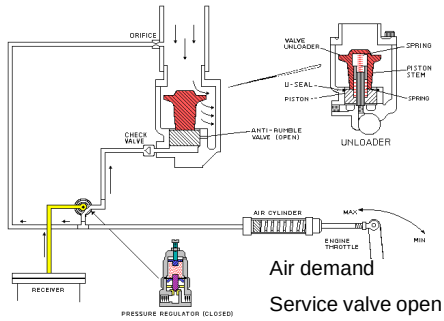
AIR FLOW & REGULATION (7/26E – 7/51)



Start-up

Service valve closed

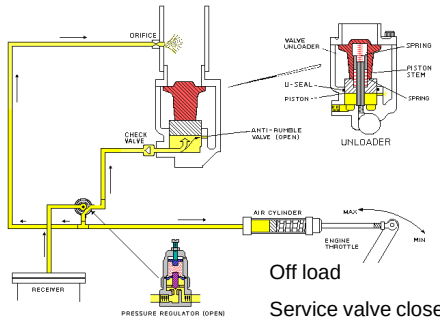
AIR FLOW & REGULATION (7/26E – 7/51)



Air demand

Service valve open

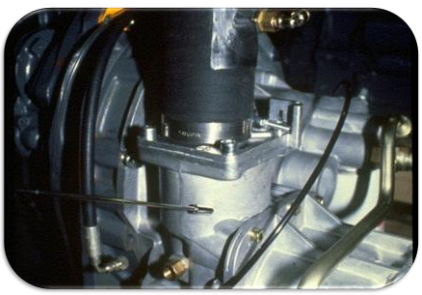
AIR FLOW & REGULATION (7/26E – 7/51)



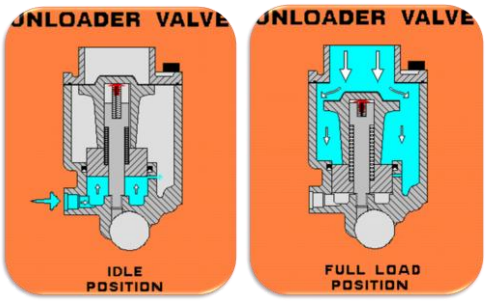
Off load

Service valve closed

AIR FLOW & REGULATION (7/26E – 7/51)

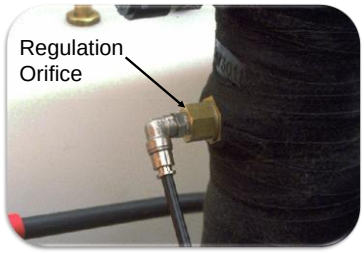


AIR FLOW & REGULATION (7/26E – 7/51)

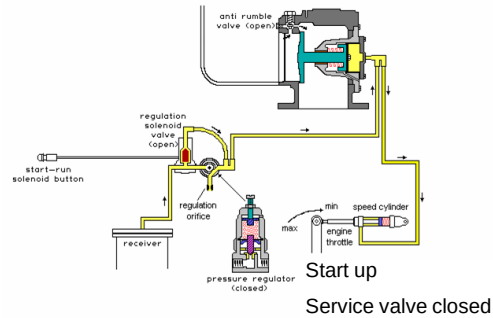


AIR FLOW & REGULATION (7/26E – 7/51)

- Connection on compressor inlet allows to reduce noise.



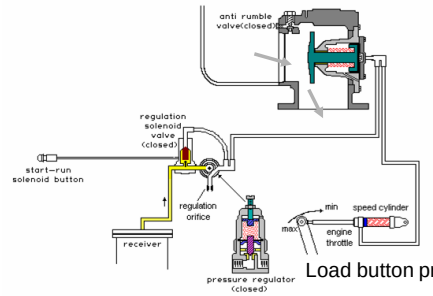
AIR FLOW & REGULATION (7/71 – 12/56)



Start up

Service valve closed

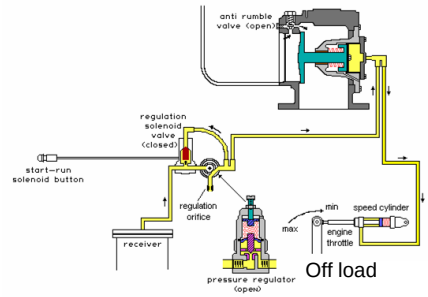
AIR FLOW & REGULATION (7/71 – 12/56)



Load button pressed

Service valve closed

AIR FLOW & REGULATION (7/71 – 12/56)



Off load

Service valve closed

AIR FLOW & REGULATION (7/71 – 12/56)

AIR FLOW & REGULATION (7/71 – 12/56)

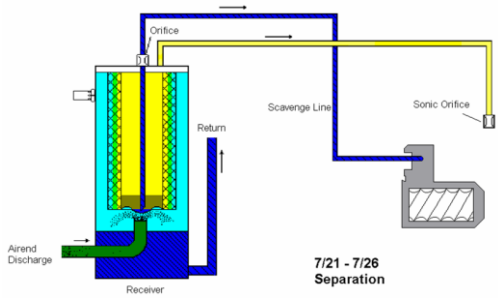
SEPARATION SYSTEM

- Functions of the separation system:
  - Removing the oil contained in the compressed air
- Most of the oil is removed from the air through a specially shaped baffle in the separator tank.
- The remaining oil is removed by the separator element.

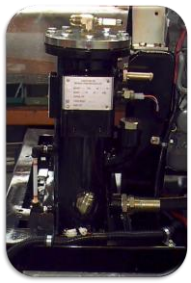
SEPARATION SYSTEM

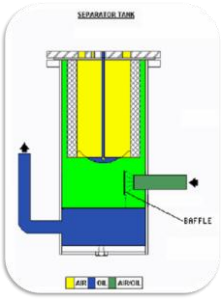
- The air and oil mixture discharges from the airend into the separator receiver. Here most of the oil separates out from the mixture under gravity when it impinges on the underside of the specially-shaped base of the separator element. The separator element then removes any remaining oil entrained in the air. The oil which flows down the inside surfaces of the element and accumulates on the base is returned via the Scavenge line (because of the pressure differential) to the airend.
- The orifice in the scavenge drop tube controls the flow rate through the scavenge line.
- The minimum pressure valve (or sonic orifice) is located before the service taps. It ensures that the pressure inside the separator receiver never falls below 4.4-5.1 bar (65-75 psi). This ensures there is sufficient oil circulation in the system at all times. It also limits the pressure drop across the separator element, thereby protecting it.

SEPARATION SCHEMATIC (7/20)



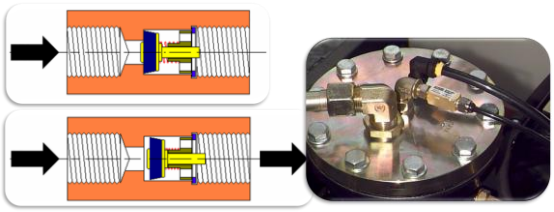
SEPARATOR/RECEIVER TANK (7/20)





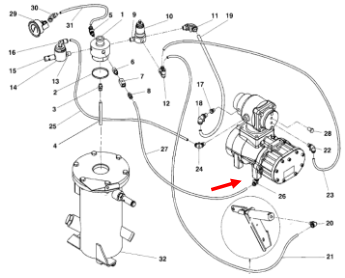
SCAVENGE LINE (7/20)

- Orifice is located in the elbow connector.
- It is designed to scavenge the oil while limiting the loss of air flow.
- Check valve prevents oil reverse flow during shutdown.



SCAVENGE LINE (7/20)

- Returns to air inlet.
- Look for clogged scavenge lines in case of oil carry over!

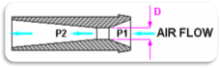


SAFETY VALVE (7/20)

- Valve is on the oil side of the element where pressure is maximum when the separator element is blocked.

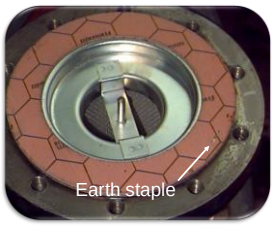
SONIC ORIFICE (7/20)

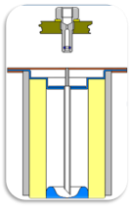
- Maintains a min. pressure (~5bar) in the receiver to:
  - keep the oil flowing.
  - limit pressure drop across the separator.
- Continuous operation at min pressure results in oil carry over due to insufficient scavenge flow.



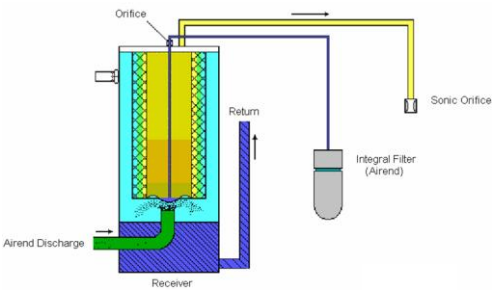
SEPARATOR ELEMENT (7/20)

- The scavenge tube is part of the separator element.





SEPARATION SCHEMATIC (7/26E – 7/51)

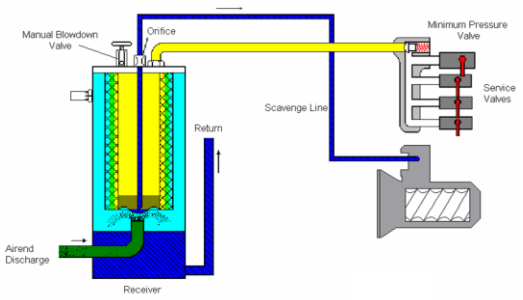


SCAVENGE LINE (7/26E – 7/51)

SCAVENGE LINE (7/26E – 7/51)

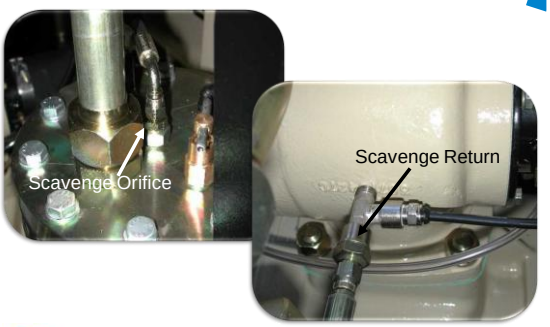
SONIC ORIFICE (7/26E – 7/51)

SEPARATION SCHEMATIC (7/71 – 12/56)



SEPARATOR TANK (7/71 – 12/56)

SCAVENGE LINE (7/71 – 12/56)



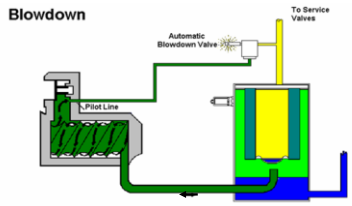
SONIC ORIFICE (7/71 – 12/56)

BLOW DOWN SYSTEM

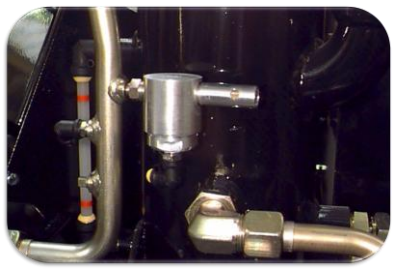
- The blow down system allows to relieve the pressure from the separator tank automatically or manually if required.

AUTO BLOWDOWN (7/20)

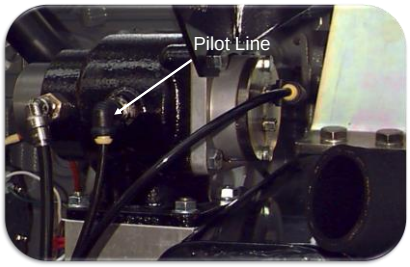
- Normally closed valve. Pilot is high pressure at inlet that appears when compressor stops and unloader check valve closes.



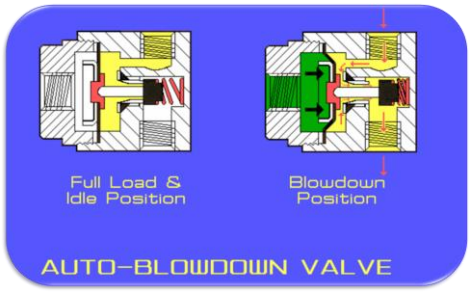
AUTO BLOWDOWN (7/20)



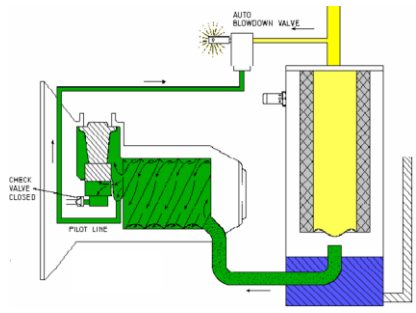
AUTO BLOWDOWN (7/20)



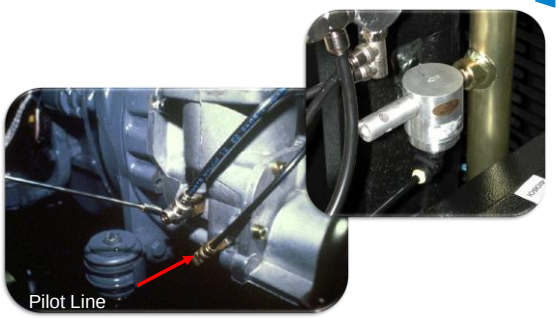
AUTO BLOWDOWN VALVE



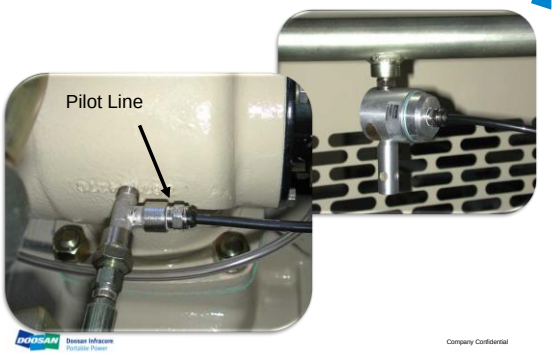
AUTO BLOWDOWN (7/26E – 7/51)



AUTO BLOWDOWN (7/26E – 7/51)

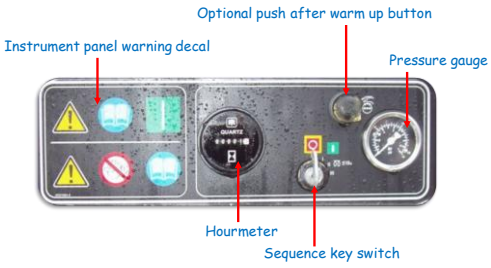


BLOWDOWN (7/71 – 12/56)

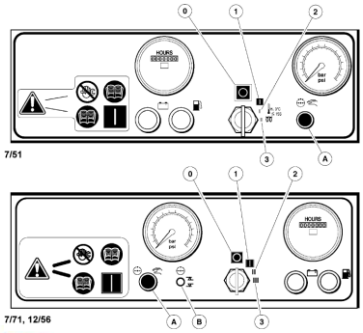


MANUAL BLOWDOWN (7/71 – 12/56)

INSTRUMENT PANEL (7/26E – 7/31E)



INSTRUMENT PANEL (7/51 – 7/71)

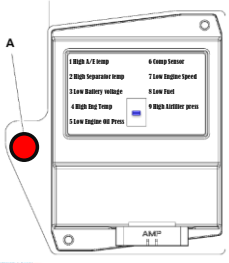


A- Load button
B- Dual pressure switch
0- "OFF" position
1- "RUN" position
2- "Override" position
3- "Crank" position

*A= optional on 7/51
std on 7/71 & 12/56
*B= optional on units able to exceed 7 bar

INSTRUMENT PANEL (7/51) Tier 3

•New Tier 3 7/51 uses standard control panel and a diagnostic readout panel called SECU.
•Diagnostic codes for compressor will be shown on the one digit display.
•Diagnostic codes for the engine will be displayed as a flash code by a separate led light. (A)

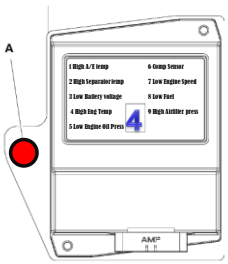


NORMAL CONDITIONS

-- **Center Bar Blinking:** Compressor is ready to start. (No fault)
H – Crank Signal Detected: Displayed while start switch is in the pre-heat or crank position.

During SECU power –up , the controller will test the display.During next step 3 digit software rev. Number will be shown.

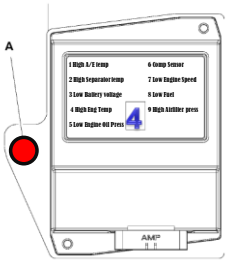
INSTRUMENT PANEL (7/51) Tier 3



ALARMS & SHUTDOWNS Compressor

1 – High A/E Temp: Indicates shutdown due to high comp temp
2 – High Separator Temp: Indicates shutdown due to high temp at separator tank discharge
3 – Low Battery Voltage: Alarm – Indicates battery or charging system malfunction
4 – High Engine Coolant Temp: Indicates shutdown due to high engine water temp
5 – Low Engine Oil Press: Indicates shutdown due to low engine oil press.
6 – Comp Sensor Failure: Indicates press sensor malfunction. Comp will not start.
7 – Low Engine Speed: Indicates shutdown due to low engine speed.
8 – Low Fuel Level: Indicates shutdown due to low fuel level. (Optional)
9 – Restricted Air Filter: Alarm. Indicates engine/comp air inlet filters need service (Optional)

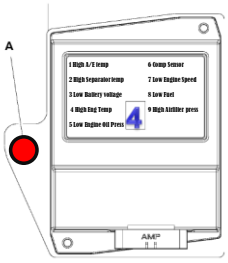
INSTRUMENT PANEL (7/51) Tier 3



ALARMS & SHUTDOWNS Compressor

A – Engine Comm Error: Engine model not recognized. Comp will start and operate within a 1700 – 2300 rpm range.
C – CAN Comm Error: CAN communication failure
E – Generator Switch Enable Error: Generator enable switch on control panel is "ON" before starting. Engine will not crank.

INSTRUMENT PANEL (7/51) Tier 3



ALARMS & SHUTDOWNS Engine (A)

Failure flashes can be read on the Engine Failure Lamp when the ON/OFF power switch is "ON" or when the unit is running.

The Failure lamp is on for 2 seconds when the ECU is powered up.

A lamp flash duration of 0.5 seconds is a "short" flash
A lamp flash duration of 1.5 seconds is a "long" flash

A flash sequence of "1 long and 3 short" would be displayed by one flash with a 1.5 second duration and 3 flashes with a 0.5 second duration.

When tow or more failures have occurred simultaneously, the failure lamp will pause for 3 seconds between flash sequences.

Failure flash sequences continuously repeat with 3 second pauses until the failure is corrected.

INSTRUMENT PANEL (7/51) Tier 3

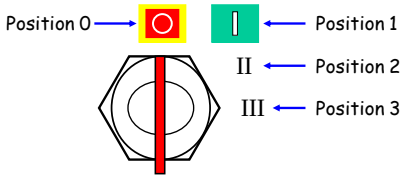
ALARMS & SHUTDOWNS Engine (A)

Failure	Failure Flashes	Remark
Coolant temperature sensor failure	4 Short	
Speed sensor failure	6 Short	
Rack position sensor failure	7 Short	
Rack actuator failure	8 Short	
EGR valve failure	1 Long and 3 Short	
CSD solenoid valve failure	1 Long and 4 Short	
Main relay failure	1 Long and 6 Short	
Rack actuator relay failure	1 Long and 7 Short	
ECU temperature alarm	2 Long and 5 Short	ECU temp > 221°F
Coolant temperature alarm	3 Long and 6 Short	Coolant temp > 239°F
ECU failure	4 Long and 1 Short	

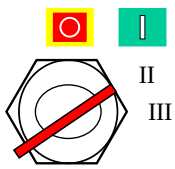
More information can be found in the Yanmar Service Manual Use this manual in conjunction with our Electronic Manual to troubleshoot the entire system.

OPERATION – STARTING

Sequence Key Switch

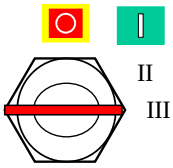


OPERATION – STARTING



Turn key switch to position 2 and hold for a maximum of 15 seconds to allow the air inlet heater to reach working temperature.

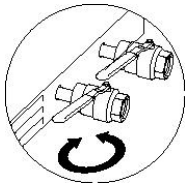
OPERATION – STARTING



Turn key switch to position 3 (engine start position), release to position 1 when the engine starts.

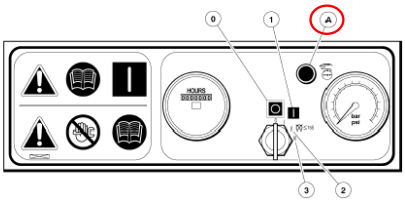
OPERATION – STARTING

- At temperatures below 0ºC or if there is difficulty starting first time:
  1. Open a service valve fully, with no hose connected
  2. Complete starting sequence as previous
  3. Close service valve as soon as engine runs freely



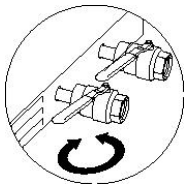
OPERATION – STARTING

- If the compressor is equipped with a start/run push button, push when the engine is warm and air is required

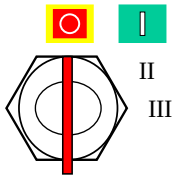


OPERATION – STOPPING

1. Close service valve(s) fully
2. Allow unit to run unloaded for a short period to reduce engine temperature



OPERATION – STOPPING



Turn key switch to position 0 (off position)

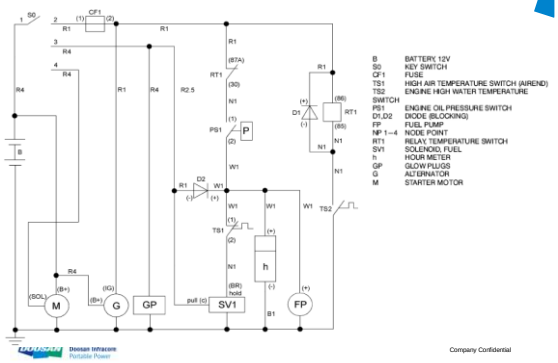
As soon as the engine stops, the automatic blowdown valve will relieve all pressure from the system. If valve fails to operate, pressure must be relieved by means of the service valve.

Never allow unit to stand idle with pressure in the system.

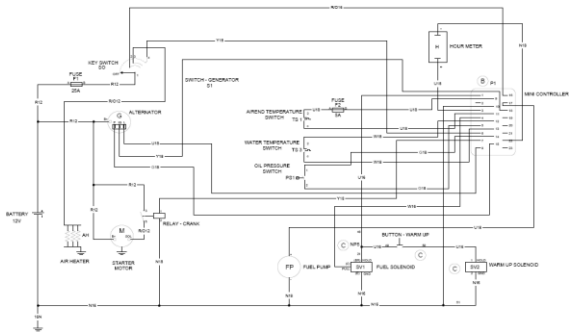
ELECTRICS

- Electrical relay operation
- Wiring diagram 7/20
- Wiring diagram 7/26E – 7/31E
- Wiring diagram 7/41
- Wiring diagram 7/51
- Wiring diagram 7/71 – 12/56

WIRING DIAGRAM (7/20)



WIRING DIAGRAM (7/26E – 7/31E)



ELECTRICS (7/26E – 7/31E)

The mini controller functions are:

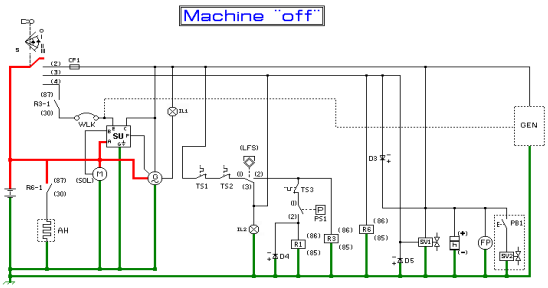
- CONTROL:
  - supplies the fuel solenoid pull-in and hold signals
  - supplies the starter solenoid signal
- SAFETY:
  - prevents the starter from being energized when the engine is running
  - prevents the engine from being started if the air end temperature is too high or fuel level is low (optional)
  - releases the fuel solenoid hold current if any switch in the shutdown chain opens while the engine is running. It provides bypass for engine oil pressure and water temperature for 20 seconds after initiating crank or until the engine is running.

ELECTRICS (7/26E – 7/31E)

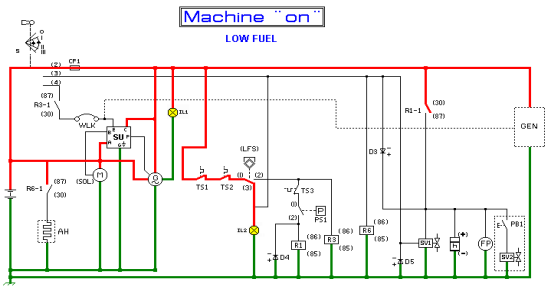
The mini controller functions are:

- DIAGNOSTICS (optional)
  - LEDs that indicate the cause of a shutdown
  - alternator light
  - Tachometer
- The air heater is driven by the key switch, not by the mini controller.

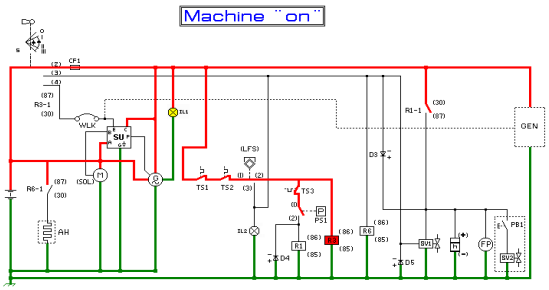
WIRING DIAGRAM (7/41)



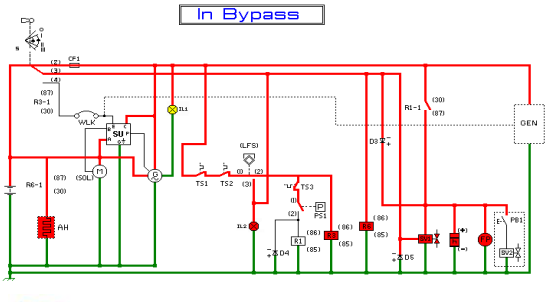
WIRING DIAGRAM (7/41)



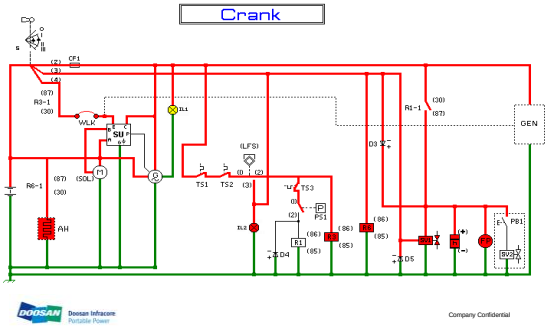
WIRING DIAGRAM (7/41)



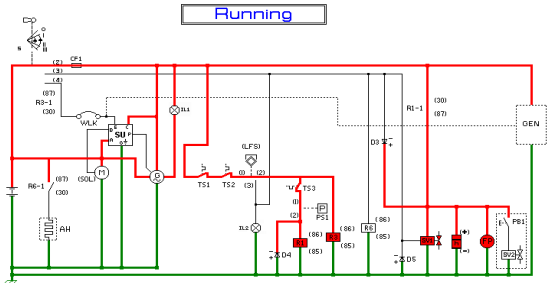
WIRING DIAGRAM (7/41)



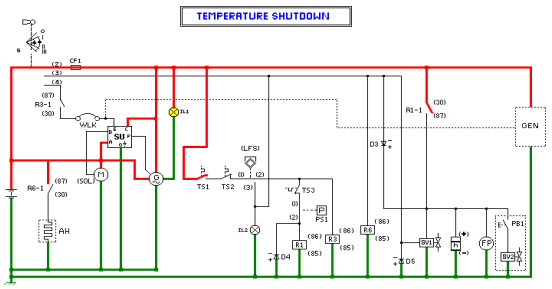
WIRING DIAGRAM (7/41)



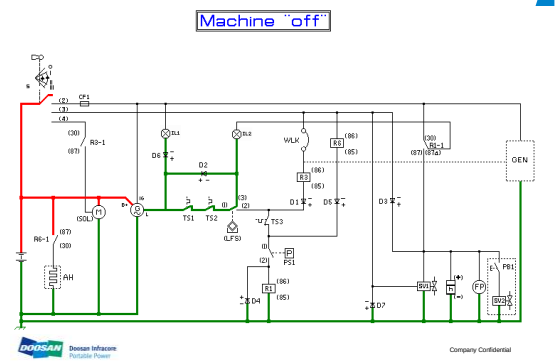
WIRING DIAGRAM (7/41)



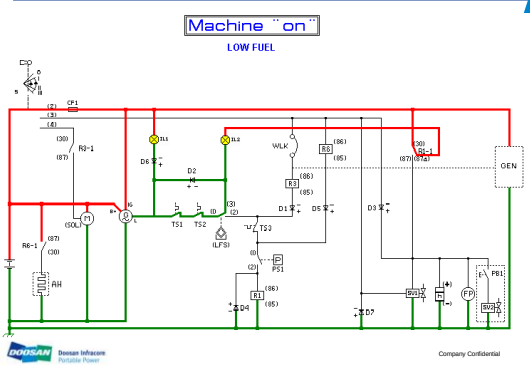
WIRING DIAGRAM (7/41)



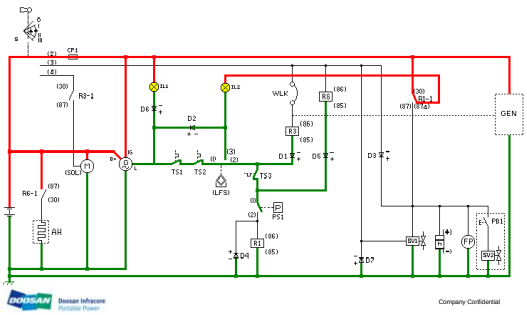
WIRING DIAGRAM (7/51 Tier 2)



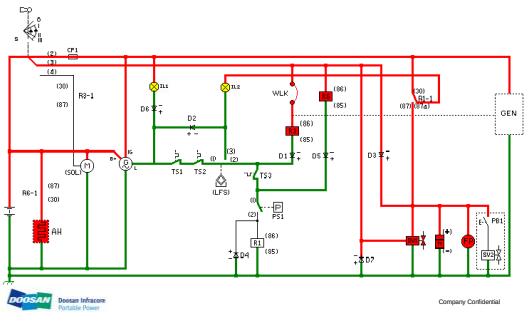
WIRING DIAGRAM (7/51 Tier 2)



WIRING DIAGRAM (7/51 Tier 2)

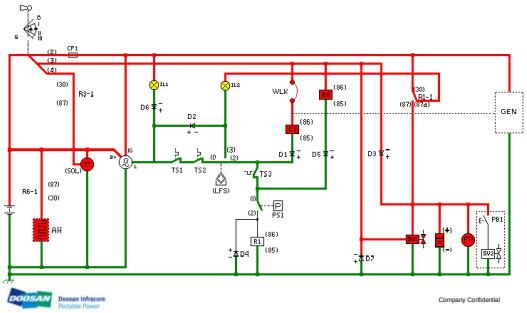


WIRING DIAGRAM (7/51 Tier 2)



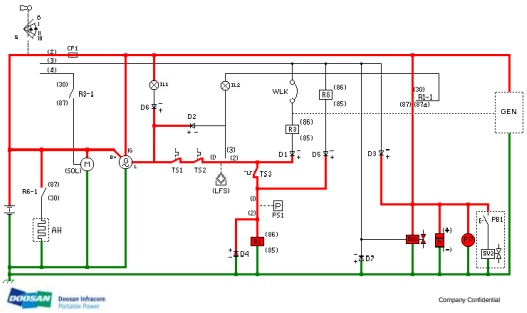
WIRING DIAGRAM (7/51 Tier 2)

Crank



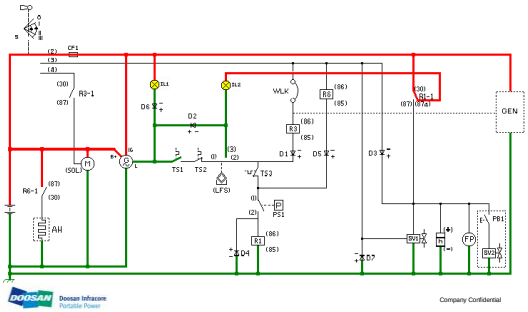
WIRING DIAGRAM (7/51 Tier 2)

Running



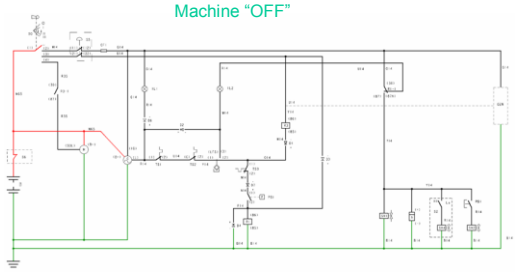
WIRING DIAGRAM (7/51 Tier 2)

TEMPERATURE SHUTDOWN



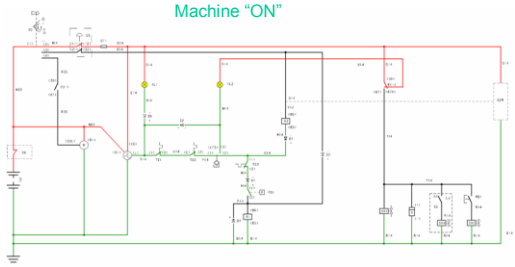
WIRING DIAGRAM (7/71 – 12/56 Tier 2)

Machine “OFF”



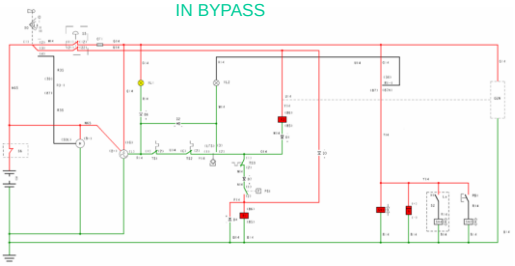
WIRING DIAGRAM (7/71 – 12/56 Tier 2)

Machine “ON”



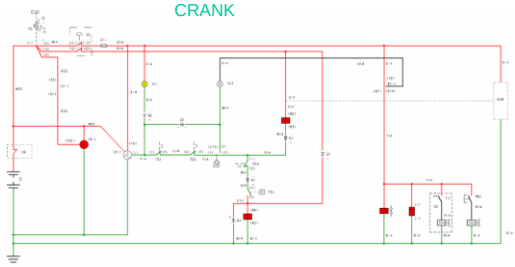
WIRING DIAGRAM (7/71 – 12/56 Tier 2)

IN BYPASS



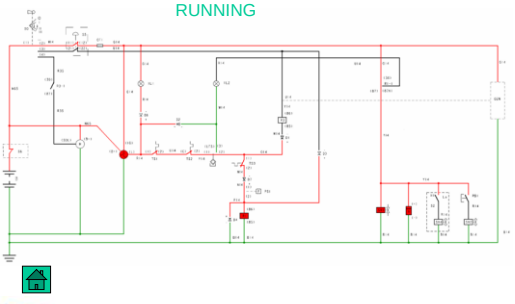
WIRING DIAGRAM (7/71 – 12/56 Tier 2)

CRANK



WIRING DIAGRAM (7/71 – 12/56 Tier 2)

RUNNING

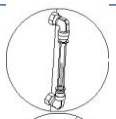


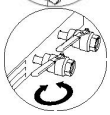
TROUBLESHOOTING

- OIL CARRYOVER
- LOW AIR VOLUME
- OVERHEATING
- HIGH PRESSURE
- STARTING PROBLEMS

OIL CARRYOVER

- Is the oil level correct, not overfilled?
- Are the service valves closed before stopping the compressor?
- Is the separator element in good condition?





OIL CARRYOVER

- Is the compressor being operated at the correct pressure?
  - Check the min pressure valve
- Is the compressor being operated at the correct engine speed?
- Is the correct type of oil being used?
- Is the scavenge line working?
  - Check scavenge orifice and check valve
  - Clean tubes
  - Check scavenge tube length

LOW AIR VOLUME

- Is the compressor being operated at the correct pressure?
  - Check the pressure regulator setting
  - Check for leaks in the regulation pipe work
  - Check if the regulator orifice is plugged
- Is the compressor being operated at the correct engine speed?
  - Check air cylinder and fuel pump throttle adjustment

LOW AIR VOLUME

- Are the air cleaners clean?
  - Check the restriction indicators and service if required
- Are there any leaks in the air pipe work?
- Is the separator element clean?

OVERHEATING

- Is the oil level correct?
- Is the correct oil grade being used?

- Are there any restrictions in the oil circuit?
  - Check the oil cooler restriction
  - Check the compressor oil filter
- Is the oil cooler clean?
- Is the oil bypass valve working?
  - Check valve operation but never remove it as the oil cooler would be bypassed

OVERHEATING

- Is the flow of cooling air re-circulating?
  - Orient the machine in the wind direction
  - Check the engine speed
  - Check the fan and drive belt operation
  - Don't run the machine with the canopy opened
- Is the ambient temperature below the LAT?
- Is the compressor being operated at the correct pressure?

HIGH PRESSURE

- Is the pressure regulator correctly operating?
  - Check the pressure setting
  - Check the diaphragm, leak at pin hole
  - Check the regulation pipe work
- Is the unloader operating correctly?
- Is the regulator orifice size correct?
- Is there a restriction across the separator element?

STARTING PROBLEMS

ENGINE WILL NOT CRANK

- Is the battery charged?
- Is the compressor inclination less than 15°?
- Is there fuel in the tank?
- Are the safety switches operating (airend discharge temp…)?

STARTING PROBLEMS

ENGINE WILL CRANK BUT NOT START

- Is the air heater operating?
- Is there a restriction or leak in the fuel lines?
- Is the engine fuel filter clean?

ENGINE TROUBLESHOOTING

- Engine diagnostics available by flash codes
  - More info can be extracted when using Yanmar YDT tool.
  - YDT also allows programming of injector or pump when replacing such items.
- EGR valve
  - This valve has a self test function which compares travel with limits stored in ecu.
  - Limited valve travel could be caused by a sooth loaded valve
    - Blocked airfilters – injector or pump issue – bad fuel.....

ENGINE PARTS REPLACEMENT PROCEDURES

- Injector replacement
  - New Injector trim file should be loaded in engine ecu (YDT)
- Pump replacement
  - New pump data needs to be loaded in engine ecu (YDT)
- Rack Actuator
  - Is mounted on the fuel pump
    - Cannot be ordered separately → needs to be replaced by a Tier 3 certified Yanmar fuel injection repair shop and pump recalibrated.
    - Only other option is to order a new pump.
- Engine ECU
  - Can be ordered from our warehouse pre-programmed after receiving the correct engine data or program by dealer with YDT.

Service Letter

- 7/20 → SL 40001 Separator install flange
  SL 40002 New exhaust design
- 7/31-7/41 → SL 40007 Wire Harness protection
- 7/26E-7/31E→ SL 40012 Fuel Filter bracket relocation
- 7/71 → SL 40013 New Coupling JD unit

- YANMAR → SL 40004 Yanmar Diagnostic Tool
- 7/20→7/51 → SL 40015 Heavy duty hose clamp