Cincinnati, Ohio USA - Glasgow, Scotland UK

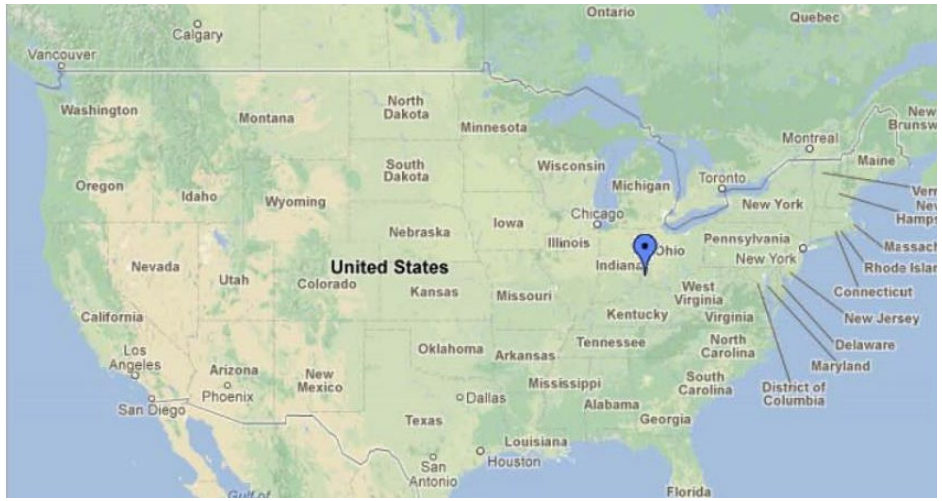
Diesel Engines for Fire Protection Applications

Based on NFPA 20 2022 Edition

www.clarkefire.com

- Assembling UL/FM diesel fire pump drivers since 1979.
- Over 200,000 engines installed globally.
- Largest provider of UL/FM diesel fire pump drivers.
- 303 UL-FM Listed Approved Engine Models (37 -> 1,200hp)
- 426 Diesel Fire Pump Engine Models (7 -> 1,128hp)
- Global Range of Non-Listed engines for emergency stand-by fire sprinkler pumps - Manufactured to various Country Code Requirements

  (EN12845, VdS, VAS, APSAD, CEPREVEN, AS2941, ASIB, SBF120, DBI, Asia NL, etc)
- Mechanical & Electronic Engines (Euro III / US Tier III Emissions)



Clarke Fire Protection Products, Inc.
100 Progress Place
Cincinnati, Ohio, USA



Clarke Fire Protection Products, LTD
Grange Works, Lomond Road,
Coatbridge, Scotland ML5 2NN, UK





Presentation Review

- Engine Sizing
- Instrument & Control
- Battery System
- Engine Cooling
- Room Requirements
- Fuel Tank
- Exhaust Sizing
- System Operations

Engine Sizing

Engine Type

- Engines shall be listed for fire pump service. (11.2.1)
- Diesel Engines for fire pump drive shall be of the compression ignition type. (11.1.3.1)
- Spark-ignited internal combustion engines shall not be used. (i.e. natural gas, propane or gasoline) (11.1.3.2)

Engine Type

- The driver (diesel or electric) shall be selected to operate the pump at rated speed and maximum pump load under **any** flow condition. (4.7.6)
- The (pump) nameplate shall indicate the maximum pump horsepower demand required to power the pump at any flow, including flows beyond 150 percent of the rated capacity. (4.11.3)

Engine Ratings

- Rated at SAE Conditions 25°C (77°F) and 91.4 m (300 ft) above sea level. (11.2.2.3)
- Engines shall have a 4-hour minimum horsepower rating not less then a 10% reserve (All UL-FM engine ratings reflect this requirement).(11.2.2.2)
- Engines must be derated for Altitude and Temperature. (11.2.2.4) & (11.2.2.5)
  - 3% Derate for every 300 m (1000 ft) above 91 m (300 ft).
  - 1% Derate for every 5.6°C (10°F) above 25°C (77° F).

Engine Selection | De-rate Calculator | Speed Interpolator

LOCATION AND ENCLOSURE

Purchase Location: US

Enclosure:
- (•) No Enclosure
- ( ) Clarke Enclosure

ENGINE FAMILY

Engine Type:
- (•) Heat Exchanger Cooled
- ( ) Radiator Cooled
- ( ) PLD

Approval:
- (•) Export
- ( ) US-EPA (NSPS)

PUMP MAX POWER

Power Units:
- (•) BHP
- ( ) KW

Max Power: 150

ENGINE/PUMP RPM

RPM:
- 1200
- 1500 (1460-1470)
- 1800 (1750-1800)
- 1900

Ctrl+Click to select multiple RPMs

Use Interpolated RPM: (•) No ( ) Yes

Interpolated RPM:

ENGINE DERATES

Units: ( ) Standard (•) Metric

Altitude (m): 650

Derate 3% for every 304.8 meters above 91.4 meters

Ambient Temperature (°C): 49

Derate 1% for every 5.55° above 25°

Right Angle Gear Loss (%): Not Used

REQUESTING PARTY

Customer:

Input By:

Job Name:

Job Number:

Engine Selection | De-rate Calculator | Speed Interpolator

USA Purchased, Heat Exchanger Cooled, Export

DATE 3/4/2018

TYPE Clarke Engine Enclosure: None

PUMP REQUIREMENTS
Pump Max Power: 150 BHP
RPM(s): 1800

DERATE PARAMETERS
Altitude: 650 meters
Ambient Temperature: 49° C
Right Angle Gear Loss: 0%
Derate Percent: 9.8%

APPLICATION INFORMATION
Customer:
Job Name:
Job Number:
Run By:

RESULTS:

Model	RPM	Rated BHP (kW)	Ventilation Fan Loss BHP (kW)	Available BHP (kW)	Derate BHP (kW)	EPA Emission Tier (Reference)	Interpolation Data (RPM, BHP)
JU6H-UFM0	1760	175 (131)	-	-	157.8 (118.1)	NSPS Compliant	Not Used
JU6H-UFM8	1760	175 (131)	-	-	157.8 (118.1)	NSPS Compliant	Not Used

ALTERNATE CERTIFIED ENGINE SELECTIONS:

Model	RPM	Rated BHP (kW)	Ventilation Fan Loss BHP (kW)	Available BHP (kW)	Derate BHP (kW)	EPA Emission Tier (Reference)	Interpolation Data (RPM, BHP)
JU4H-UFAD98	1760	175 (131)	-	-	157.8 (118.1)	NSPS T3-Certified	Not Used

- At what altitude and temperature is the listed horsepower guaranteed?
  - SAE levels - 91.4 meters (300 feet) above sea level and 77F (25C).
- What is the derate for altitude?
  - 3% for every 300 meters (1,000 feet) above 91 meters (300 feet)
- What is the derate for temperature?
  - 1% for every 5.6C (10F) above 25C (77F).
- What is ambient temperature?
  - The temperature at the engine air inlet while the engine is running at maximum pump flow.

- What are the 3 reasons to use the Clarke Engine Selection Calculator?
  - Use to verify that the Clarke engine selected matches the engine selection from the pump program.
  - Use to submit to the specifying engineer or design sprinkler contractor to verify that everyone is using the same derate factor.
  - Keep a copy in your records to prove you have selected an engine large enough for the site conditions (altitude and temperature).

Instrument & Control

- Required Gauges: (11.2.5.1.1-4)
  - Tachometer – indicates RPM's
  - Oil Pressure Gauge
  - Coolant Temperature Gauge
  - Hour meter – records engine run time
- Additional Gauges:
  - Two voltmeters – one for each set of batteries

- The engine instrument panel shall not be used as a junction box or conduit for any AC supply.(11.2.5.1.2)
- Interconnections between the automatic controller and engine junction box shall be made using stranded wire sized on a continuous-duty basis.(11.2.6.2.1)
- The DC interconnections between the automatic controller and engine junction box and any AC power supply to the engine shall be routed in separate conduit.(11.2.6.2.2)

Electronic Engines

- Engines with an electronic control module (ECM) shall have an alternate ECM wired to produce full power in the event of primary ECM failure.(11.2.4.2.1)
- There shall be a single ECM Selector Switch, with no off position, to transition from the primary ECM to the alternate ECM. (11.2.4.2.3.1 (a))
- A visual indicator shall show when the engine is running with the alternate ECM. (On both the engine panel and on the diesel controller). (11.2.4.2.3.2)


MODE SELECTOR
MANUAL RUN
AUTOMATIC
WARNING
MODE SELECTOR NOT IN AUTOMATIC
AIR FILTER RESTRICTION
0 inWC
OIL LEVEL
COOLANT LEVEL
OIL TEMP
67 F°
OIL FILTER DIFF. PRESS.
LEVEL NORMAL
LEVEL NORMAL
0.0 PSI
DISPLAY ON
USE ONLY IF DISPLAY IS OFF
CLARKE
CAUTION
DO NOT RUN ENGINE WITHOUT AIR FILTER INSTALLED.
PERSONAL INJURY OR ENGINE DAMAGE MAY RESULT.
C13191
FIRE PUMP ENGINE - MANUAL OPERATING INSTRUCTIONS
TO START ENGINE
1. Position MODE SELECTOR switch to MANUAL RUN.
2. Lift and hold MANUAL CRANK #1 until engine starts, or release after 15 seconds. If unit fails to start, wait for 15 seconds, use MANUAL CRANK #2 and repeat step.
3. If COOLING WATER is not flowing or engine TEMPERATURE is too high open cooling system manual by-pass valve.
TO STOP ENGINE
1. Lift and hold MANUAL STOP until Engine Stops.
2. Return MODE SELECTOR switch to AUTOMATIC position.
3. Close cooling system manual by-pass valve, if opened.
IMPORTANT
DO NOT leave the MODE SELECTOR switch in the MANUAL RUN position during AUTOMATIC operation.
WARNING
THIS EQUIPMENT STARTS AUTOMATICALLY
USE EAR PROTECTION
C13187
WARNING
OPERATING ON ALTERNATE ECM
EMERGENCY FAILED TO START INSTRUCTIONS
SELECT ALTERNATE ECM
If a failed to start condition has occured, move the ECM selector switch to the ALTERNATE ECM position, then follow manual operating instructions above.
ALTERNATE ECM WARNING:
DO NOT SWITCH WHILE THE ENGINE IS RUNNING
PRIMARY ECM
ECM SELECTOR
MANUAL STOP
MANUAL CRANK #1
MANUAL CRANK #2
C12C209

Electronic Engines

- Any sensor necessary for the function of the ECM that affects the engine from producing rated power shall have a redundant sensor that shall operate automatically in case of failure. (11.2.4.2.5)
- A signal shall be provided to the diesel controller for fuel injection failure, low fuel pressure and any primary sensor failure. (11.2.4.2.6)
- The transition from the primary ECM to the alternate ECM shall be accomplished automatically upon failure of the primary ECM (11.2.4.2.3.1 ((a))

Electronic Engines

- ECM auto switching must happen in either primary or alternate ECM to the opposite. (11.2.4.2.3.1 ((b))
- Two new terminals
  - 303 – Single ECM Failure Alarm Signal
  - 304 – Dual ECM Failure Alarm Signal
  - New Toggle in the Engine Gauge Panel to reset either a 303 or 304 alarm signal.

Engine-to-Controller Connections

Terminal	Interconnect Function	Action	Controller Description
1	Signal from Controller	Energize to Run	
2	Signal to Controller	Engine Running (Engine reaches 1000 rpm)	Engine Run
3	Signal to Controller	Over Speed Alarm	Engine Overspeed
4	Signal to Controller	Low Oil Pressure Alarm	Low Oil Pressure
5	Signal to Controller	High Coolant Temperature Alarm	High Engine Temperature
6	Power Supply and Charging	Battery Set #1 Charging	
(7)	(Not used)		
8	Power Supply and Charging	Battery Set #2 Charging	
9	Cranking Signal from Controller	Controller Manual Start #1	
10	Cranking Signal from Controller	Controller Manual Start #2	
11	Common Ground		
12	Signal from Controller	Energize to Stop	
301	Signal to Controller	Alternate ECM Manually Selected	ECM Selector in Alt position
302	Signal to Controller	General Fault Alarm (Read Engine Display)	Fuel Injection Malfunction
303	Signal to Controller	Single ECM Failure Alarm	ECM Warning
304	Signal to Controller	Dual ECM Failure Alarm	ECM Failure
305	Signal to Controller	PLD-S Low Suction Pressure Alarm	Low Suction Pressure
310	Signal to Controller	High Raw Water Inlet Temp (cooling loop)	High Raw Water Temp
311	Signal to Controller	Low Raw Water Flow (restricted cooling loop)	Low Raw Water Flow
312	Signal to Controller	Low Coolant Temperature Alarm (Heater Failure)	Low Engine Temperature

Typical Wire Size **

**Refer to Controller Manufacturer's Installation Instructions for minimum size recommendations.

1-5,9,10,12,301-305,310-312	14 Gauge (2.5 mm) Stranded Wire
#6, 8, 11	10 Gauge (6 mm) Stranded Wire

Terminals in Green are for electronic engines only

Alarm Testing

- Means shall be provided for verifying overspeed switch & circuitry shutdown function, testing the oil pressure signal, testing the high engine temperature signal, testing the low engine temperature signal and testing the high cooling water temperature signal. (11.2.4.4.1-8)
- The engine shall send a signal to the controller, resulting in a visible and common audible alarm on the controller. (11.2.4.4.1-8)

Alarm Signals

- Running from the engine gauge panel is for emergency purposes and start up testing only!
  - Any time you run from the engine gauge panel, the controller must be turned off.
  - Over speed shut down will function.
  - Low Oil Pressure and High Coolant alarm will not function.
  - Engine events will not be recorded in the controller.

Alarm Signals

- Operating from the diesel fire pump controller
  - This should always be your first option for starting and stopping the engine.
  - The controller determines the actions of an alarm signal
    - In automatic or manual start the controller only alarms for low oil pressure and high water temperature.
    - In test mode the controller will alarm and shut down the engine for low oil pressure and high water temperature.

Alarm Signals

NOTE:

If the engine has started because of a drop in water pressure, the diesel fire pump controller believes there is an emergency and will ONLY alarm for low oil pressure or high coolant temperature.

Therefore it is imperative that any time the engine is running, someone must be in the pump room monitoring the engine.

Battery System

Battery System

- Engines with only one cranking motor shall include a main battery contactor installed between each battery & the cranking motor capable of manual mechanical operation (11.2.7.2.2.1)
- Engines with two cranking motor shall have one cranking motor dedicated to each battery including a mechanical switch on the engine instrument panel to energize the starting motor. (11.2.7.2.2.2)

Battery System

- Two means for recharging batteries shall be provided. (11.2.7.2.5.1)
- One method shall be the alternator. (11.2.7.2.5.2) The other method shall be a battery charger (11.2.7.2.5.3)

Engine Batteries

- Batteries shall be sized on a 72 hours stand by power without AC power being available. (11.2.7.2.1.6)
- Nonessential loads shall not be powered from the engine start batteries. (11.2.7.2.3.1)
- Electrolyte shall be added a minimum of 24 hours prior to the time the engine has to be started. (14.2.6.6.7.1)

Engine Batteries

- Each engine shall be provided with two storage battery units (unit A and unit B). (11.2.7.2.1.1)
- At 4.5°C (40°F) battery unit A shall have the capacity sufficient to maintain the during 6 consecutive cycles of 15 seconds of cranking and 15 seconds of rest. (11.2.7.2.1.4)
- At 4.5°C (40°F) battery unit B shall have the capacity sufficient to maintain the during 6 consecutive cycles of 15 seconds of cranking and 15 seconds of rest. (11.2.7.2.1.5)

Engine Batteries

- The combination of battery unit A and unit B provides sufficient capacity for a total of 12 consecutive cycles of 15 seconds of cranking and 15 sec of rest. (A11.2.7.2.1.4)
- Electrolyte shall be added a minimum of 24 hours prior to the time the engine has to be started. (14.2.6.6.7.1)

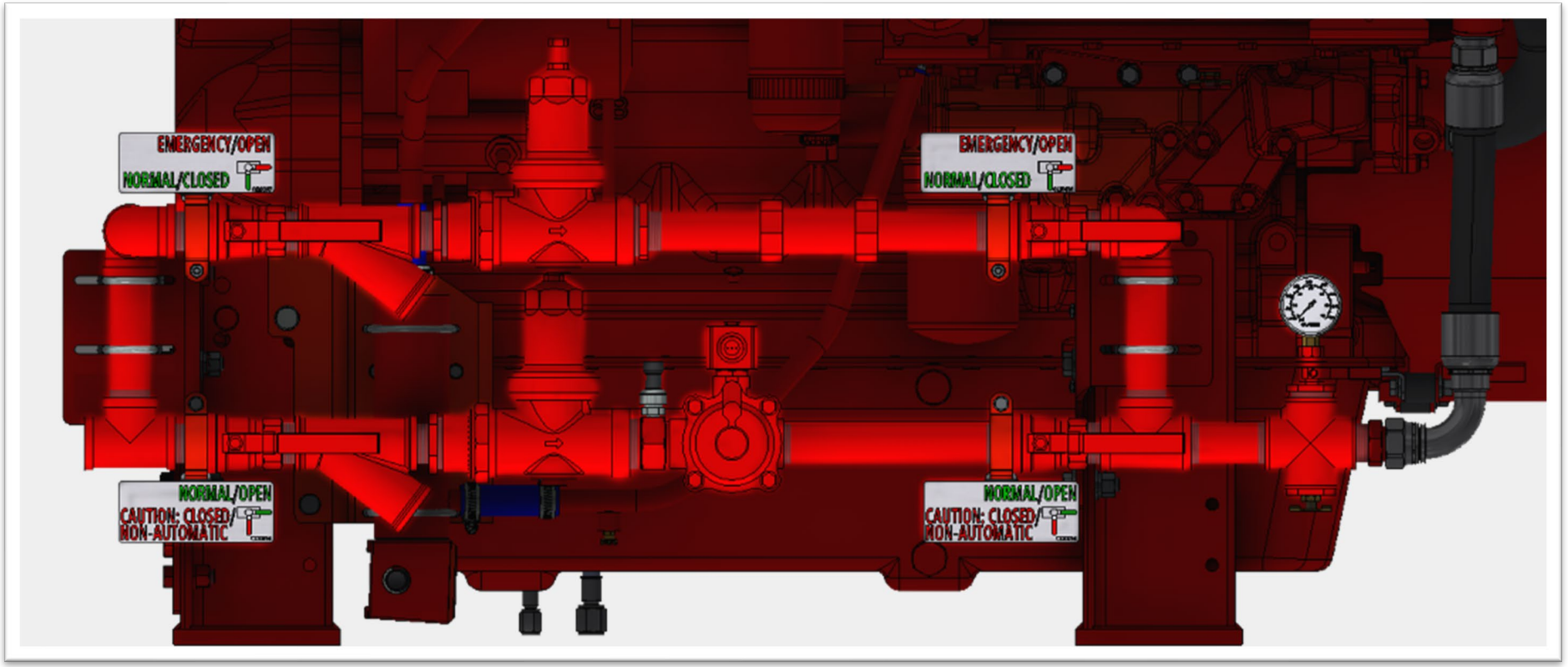
Engine Batteries

- Storage batteries shall be rack supported above the floor to prevent water damage. (11.2.7.2.4.1)
- Storage batteries shall be readily accessible for servicing. (11.2.7.2.4.3)
- Storage batteries shall not be located in front of the engine mounted instruments and controls. (11.2.7.2.4.4)



Heat Exchanger/Cooling Loop

- For Heat Exchanger cooled fire pump drivers a cooling loop or by-pass loop is used to supply pump water (raw water) from the pump to the heat exchanger.
- The cooling loop contains two paths for delivering water to the heat exchanger for redundancy.
- Each path contains a strainer, pressure regulator and isolation valves to allow for cleaning of the water strainers.


EMERGENCY/OPEN
NORMAL/CLOSED
EMERGENCY/OPEN
NORMAL/CLOSED
NORMAL/OPEN
CAUTION: CLOSED/
NON-AUTOMATIC
NORMAL/OPEN
CAUTION: CLOSED/
NON-AUTOMATIC

Heat Exchanger/Cooling Loop

- Cooling water shall be piped through a threaded rigid pipe from the discharge of the pump to the inlet of the heat exchanger. (11.2.8.5.1) & (11.2.8.5.3.1)
- Nonmetalic flexible sections shall be allowed between the pump discharge and cooling water provided they have 2 times the fire pump discharge rated pressure & 30 minute fire resistance equal to ISO 15540.(11.2.8.5.3.2)

Heat Exchanger/Cooling Loop

- The outlet from the heat exchanger shall not be less then one size larger than the inlet. (11.2.8.7.1)
- The outlet from the heat exchanger shall provide discharge into a visible open waste cone. (11.2.8.7.2)

Heat Exchanger/Cooling Loop

- The outlet shall be permitted to discharge to a suction reservoir, provided a visual flow indicator and temperature indicator are installed. (11.2.8.7.3)
- Where pump discharge is piped back to pump suction, the controller shall provide a visual indicator & audible alarm and stop the engine when a cooling water temperature signal as long as there are no active emergency requirements. (4.20.7.2)

Cooling Loop Calculator

- The standard cooling loop is designed to meet the following parameters:
  - 100F (38C) Raw Water Temperature
  - 80 psi (5.5 bar) Inlet Pressure
  - 10 psi (0.7 bar) Residual Pressure at the outlet of the heat exchanger
- If the above parameters are exceeded, you need to run our cooling loop calculator to make sure the cooling loop is large enough to cool the engine.

Cooling Loop Calculator

- Types of installations you should always run the cooling loop calculator:
  - Ground water storage tanks located in desert regions where the raw water temperature can exceed 100F (38C).
  - Where the discharge water is piped back to a ground water storage tank potentially heating the raw water temperature past 100F (38C).

Cooling Loop Calculator

- For standard cooling loops which have been calculated to be capable of cooling the engine for raw water temperatures exceeding 100F (38C), Clarke has a series of no cost optional high raw temperature alarms available to prevent nuisance alarms.

EXHAUST BACKPRESSURE CALCULATOR
PUMP ROOM VENTILATION CALCULATOR
DIESEL FUEL LINE SIZING FORM
PLD CALCULATOR
SPLD CALCULATOR
WATER TEMPERATURE RISE CALCULATOR
PLD RECALL
COOLING LOOP RECALL

LOCATION

- (•) USA Purchased
- ( ) UK Purchased

UNITS

Temperature: Deg F

Pressure: PSI

Length/Distance: Feet

Flow: GPM

Engine Series: JU4H, JU6H, ZF6H, DP6H, DQ6H, JW6H, JX6H, DR8H, DS0H, DT2H

Models: UFAEA0, UF10, UF12, UF14, UF20, UF22, UF24, UFAEE8, UFAEF2, UF34, UFH0, UFADJ8, UFADJ2, UFH2, UF40

RPM/HP: 2350 / 55HP (41KW), 2600 / 59HP (44KW), 2800 / 70HP (52KW), 3000 / 71HP (53KW)

LOOP

Loop Material
- (•) Galvanized-250 psi (17.2 bar)
- ( ) Sea Water-250 psi (17.2 bar)
- ( ) Stainless Steel-250 psi (17.2 bar)
- ( ) High Pressure-400 psi (27.6 bar)

Pump Type
- (•) HSC/End Suction
- ( ) Vertical Turbine

PUMP AND SYSTEM

Raw Water Inlet Temp: 119 (°F)

Suction Supply
- ( ) City main
- (•) Ground storage tank

Suction Pressure (Residual) at 150% Flow: 5 (psi)

Pump Pressure at 150% Flow: 92 (psi)

Total Discharge Pressure at 150% Flow*: 97 (psi)

Return Water
- ( ) Floor Drain
- (•) Storage Tank

Elevation: 40 (ft)

Calculated Static Backpressure **: 56.9 (psi)

* Inlet pressure to the cooling loop.
** Elevation value determines the static backpressure only.

OUTLET PIPING

Horizontal and Vertical Straight Pipe***: 65 (ft)

Number of 90° Elbows: 7

*** The value input for pipe length must include the total of all horizontal and vertical pipe lengths.

Cooling Loop Calculator

PUMP ROOM DESIGN TOOL

- ENGINE SELECTION CALCULATOR
- COOLING LOOP CALCULATOR
- EXHAUST BACKPRESSURE CALCULATOR
- PUMP ROOM VENTILATION CALCULATOR
- DIESEL FUEL LINE SIZING FORM
- PLD CALCULATOR
- SPLD CALCULATOR
- WATER TEMPERATURE RISE CALCULATOR
- PLD RECALL
- COOLING LOOP RECALL

Cooling Loop Calculator

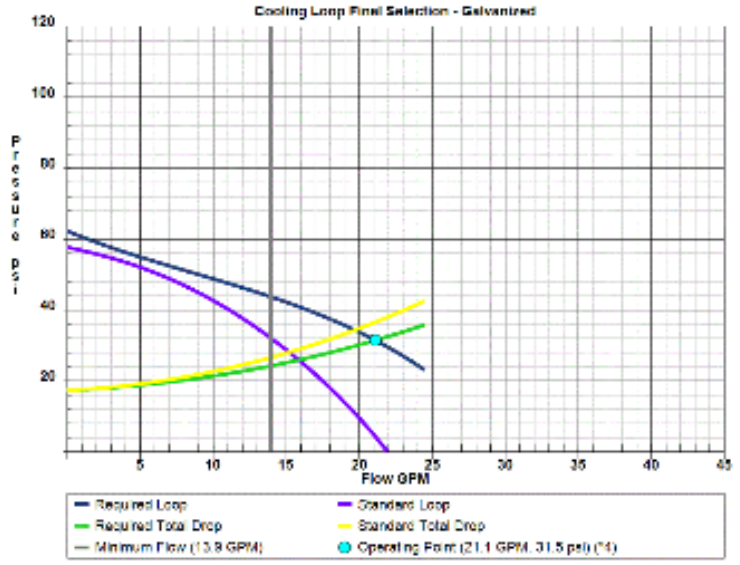
HOME / PUMP ROOM DESIGN TOOL / COOLING LOOP CALCULATOR

Cooling Loop Result

Required Loop Size:	0.75"
Heat Exchanger Minimum Outlet Pipe Size (*5):	1.25"
Standard Loop Size:	0.5"

Result: must use required loop size, log number 10013 assigned

Inlet water temperature requires the use of temperature switch 0C072494 with a setpoint of 125°F (52°C)



Operating Point*:	21.1 GPM, 31.5 psi
P/N (Ref):	C051476, 80 psi curve

* Calculated value of intersection point of cooling loop pressure drop curve (blue) to the pressure resistance curve (green) of all components down stream of cooling loop (intersection point indicated by "o").The loop size selected(stated above) is acceptable because the specific engine model minimum raw water flow requirement(gray vertical line) is less than the flow rate at the intersection point, ie, "o". Note the raw water flowrate is necessary to keep the engine from overheating.

Note: The Clarke Log Number must be referenced (or a copy of this Printout must be furnished) with any engine purchase order to Clarke FPPG.

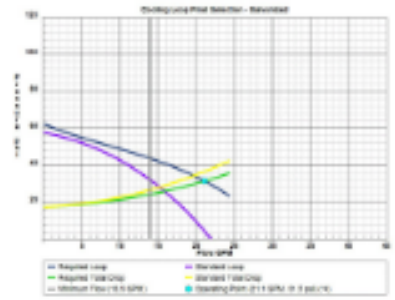
CLARKE®

Cooling Loop Selection

DATE: 3/6/2018 **LOG:** 10014

Note: The Clarke Log Number must be referenced (or a copy of this Printout must be furnished) with any engine purchase order to Clarke FPPG.

ENGINE	Model:	JU4H-UF14
	Rating:	71HP, 3000RPM
PUMP AND SYSTEM	Loop Material:	Galvanized
	Pump Type:	HSC or End Suction
	Raw Water Inlet Temp (*1):	119 °F
	Suction Supply:	Ground Storage Tank
	Suction Supply Pressure (Residual) at 150% flow:	5 psi
	Pump Pressure at 150% flow:	92 psi (cooling loop inlet pressure)
	Total Discharge Pressure at 150% flow:	97 psi
	Return Water:	Storage Tank
	Elevation (*2):	40 ft (40 psi)
OUTLET PIPING		65 ft
	Horizontal and Vertical Straight Pipe (*3):	7
	Number of 90° Elbows:	
APPLICATION	Customer:	Job Name:
	Job Number:	Run By:
RESULTS	Required Loop Size:	0.75"
		1.25"
	Heat Exchanger Minimum Outlet Pipe Size (*5):	0.5"
	Standard Loop Size:	



Engine Coolant

- Coolant is included with the engine.
- Water, ethylene glycol, inhibitor coolant mixture. 50% water 50% coolant.
- Coolant to conform to ASTM D6210.
  - Heat transfer
  - Corrosion resistance
  - Prevents cavitation
  - Prevents scale and sludge build up
  - Provides freeze and boil over protection
- Pre-mix before installing in engine to prevent premature engine heater failure.

Engine Heater

- Coolant heater is the only AC power on engine; Separate AC junction box required. Do not use controller AC for power supply. (11.2.8.2)
- Add coolant mixture *before* applying AC power.
- All heaters single voltage; Optional AC voltages available - location specific.
- Engine coolant maintained at 49°C (120°F). (11.2.8.2)

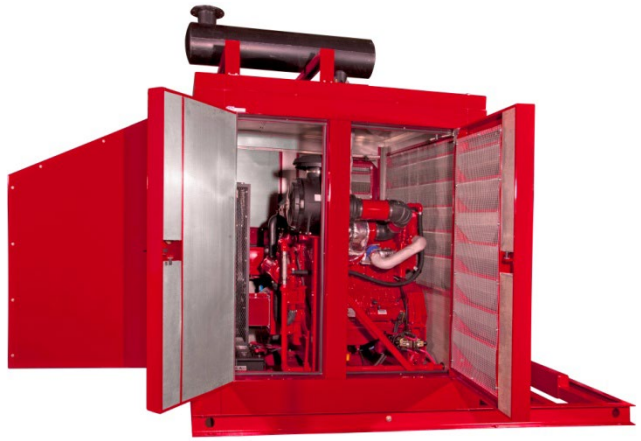
Room Requirements

Room Requirements

- End Suction and Horizontal Split Case pumps and driver shall be mounted on a common grouted base plate. (6.4.1)
- The base plate shall be securely attached to a solid foundation in such a way that pump and driver shaft alignment is ensured (6.4.3) and shall be set level on the foundation. (6.4.5)
- The foundation shall be sufficiently substantial to form a permanent and rigid support for the base plate (6.4.4)

Engine Protection

- The engine shall be protected against possible interruption of service through explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse conditions. (4.14.1)
- Application: The engine must be installed inside or protected from the weather and low temperature.

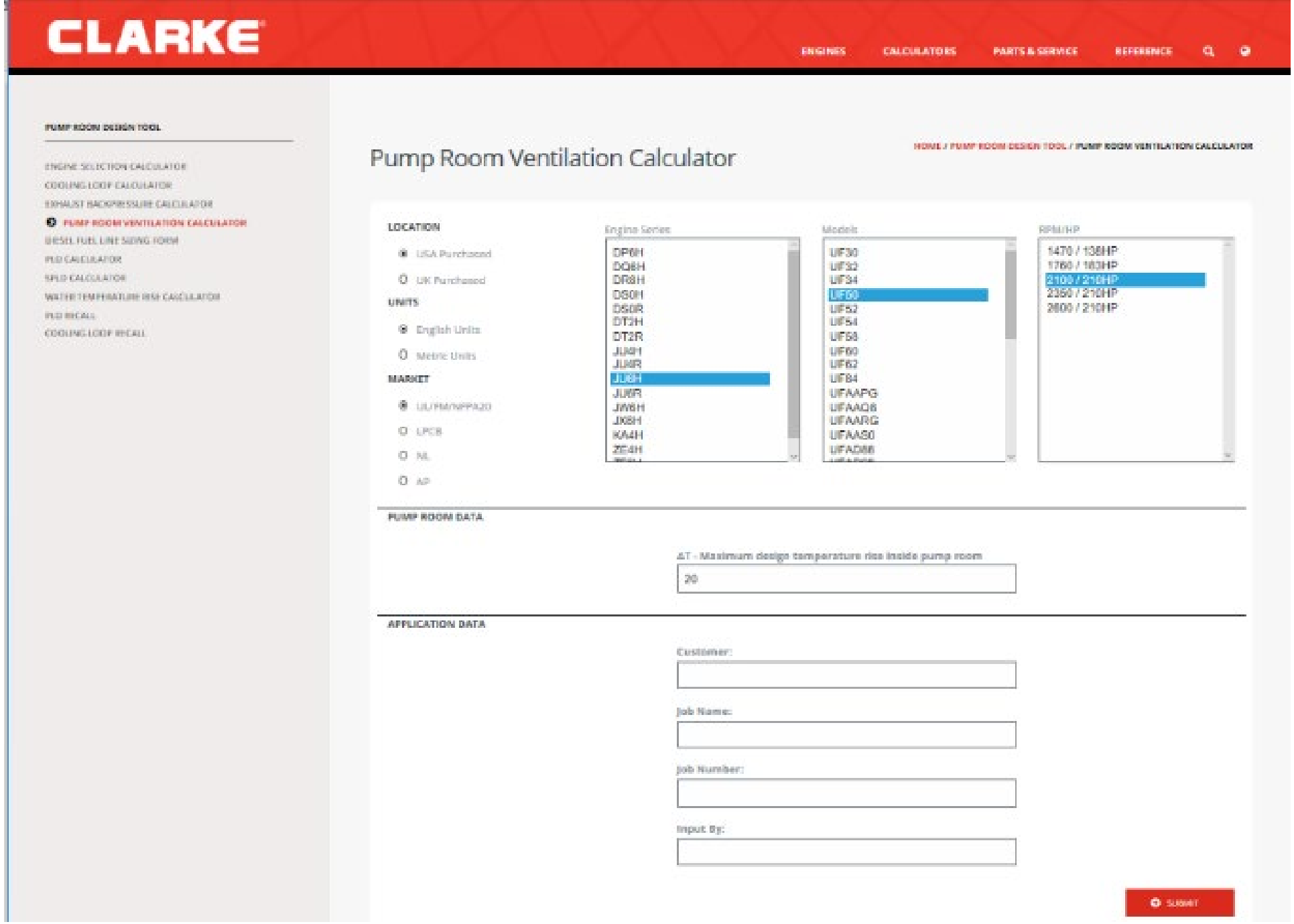


Room Temperature Requirements

- The minimum ambient temperature for the pump room is 4°C (40°F). (4.14.3.1)
  - An approved or listed source of heat shall be provided for maintaining the temperature of a pump room or pump house.
- The maximum temperature for the pump room is 49°C (120°F) at the air cleaner inlet with the engine running at rated load. (11.3.2.1)

Air Requirements

- Inlet louver and ventilating system must:
  - Limit to 49°C (120°F) in the room (11.3.2.1)(1)
  - Supply adequate air for engine combustion (11.3.2.1)(2)
  - To remove hazardous vapors. (11.3.2.1)(3)
- Radiator Cooled Units shall be ducted outdoors in a manner that will prevent recirculation. (11.3.2.4.3.1)
- Radiator Cooled Units requires more air for combustion and radiated heat removal.
- To ensure adequate airflow there should be no more than 0.5 inch of restriction between the air supply and discharge ventilators. (11.2.8.8.4.2)


CLARKE
ENGINES
CALCULATORS
PARTS & SERVICE
REFERENCE
PUMP ROOM DESIGN TOOL
ENGINE SELECTION CALCULATOR
COOLING LOOP CALCULATOR
EXHAUST BACKPRESSURE CALCULATOR
PUMP ROOM VENTILATION CALCULATOR
DIESEL FUEL LINE SIZING FORM
FLD CALCULATOR
SFLD CALCULATOR
WATER TEMPERATURE RISE CALCULATOR
FLD RECALL
COOLING LOOP RECALL
Pump Room Ventilation Calculator
HOME / PUMP ROOM DESIGN TOOL / PUMP ROOM VENTILATION CALCULATOR
LOCATION
USA Purchased
UK Purchased
UNITS
English Units
Metric Units
MARKET
UL/FM/NFPA20
LPCB
NL
AP
Engine Series
DP6H
DQ8H
DR8H
DS0H
DS0R
DT3H
DT2R
JU4H
JU4R
JU6H
JU6R
JW6H
JX6H
KA4H
ZE4H
Models
UF30
UF32
UF34
UF50
UF52
UF54
UF58
UF60
UF62
UF84
UFAAPG
UFAAQ6
UFAARG
UFAAS0
UFAD86
RPM/HP
1470 / 136HP
1760 / 163HP
2100 / 210HP
2350 / 210HP
2600 / 210HP
PUMP ROOM DATA
ΔT - Maximum design temperature rise inside pump room
20
APPLICATION DATA
Customer:
Job Name:
Job Number:
Input By:
SUBMIT

PUMP ROOM DESIGN TOOL

ENGINE SELECTION CALCULATOR
COOLING LOOP CALCULATOR
EXHAUST BACKPRESSURE CALCULATOR
PUMP ROOM VENTILATION CALCULATOR
DIESEL FUEL LINE SIZING FORM
FLO CALCULATOR
SPLO CALCULATOR
WATER TEMPERATURE RISE CALCULATOR
FLO RECALL
COOLING LOOP RECALL

Pump Room Ventilation Calculator

HOME / PUMP ROOM DESIGN TOOL / PUMP ROOM VENTILATION CALCULATOR

Results

Input Data

Engine Model: JU6H-UFS0
Rated HP: 210
Rated Speed (RPM): 2100
Combustion air flow (CFM): 433 [2]
ΔT - Maximum design temperature rise inside pump room (°F): 20 [3]
Engine radiated heat (Btu/Sec): 16 [2]

Pump Room Calculations [1]

	433	Combustion air flow (CFM)
+	2,583	Flow for engine radiated heat (CFM)
	3,016	Total (CFM)

[1] The formula used in this calculation provides a general guideline for ventilation air flow required in the pump room to carry away the Engine Radiated Heat load. This recommended air flow may not be appropriate for every installation and all environmental conditions.

[2] You will find Engine Combustion Air Flow and Radiated Heat on the Clarke model specific Installation & Operation (I&O) datasheet. I&O datasheets can be downloaded from www.clarkefire.com.

[3] ΔT is the design temperature rise you will allow in the pump room to carry away the Engine Radiated Heat. Typically 15°F - 20°F is used for this value but a higher value can be used. Note that the pump room temperature should not exceed 120°F. Also, for pump room temperatures over 77°F you must also apply the appropriate NFPA 20 BHP Derate for ambient temperature.

[4] NFPA 20 requires that the pressure drop across air inlet and outlet louvers not exceed .2" of water while flowing this total air flow. Consult a louver manufacturer to obtain pressure drop versus flow curves on specific louvers to select one that satisfies this requirement.

Print

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Pump Room Ventilation Calculator - Results

Calculations made 03/06/2018

Application Data

Customer:

Job Name:

Job Number:

Input By:

Input Data

Engine Model: JU6H-UF50

Rated HP: 210

Rated Speed (RPM): 2100

Combustion air flow (CFM): 433 [2]

ΔT - Maximum design temperature rise inside pump room (°F): 20 [3]

Engine radiated heat (Btu/Sec): 16 [2]

Pump Room Calculations [1]

	433	Combustion air flow (CFM)
+	2,583	Flow for engine radiated heat (CFM)
	3,016	Total (CFM)

[1] The formula used in this calculation provides a general guideline for ventilation air flow required in the pump room to carry away the Engine Radiated Heat load. This recommended air flow may not be appropriate for every installation and all environmental conditions.

[2] You will find Engine Combustion Air Flow and Radiated Heat on the Clarke model specific Installation & Operation (I&O) datasheet. I&O datasheets can be downloaded from www.clarkefire.com.

[3] ΔT is the design temperature rise you will allow in the pump room to carry away the Engine Radiated Heat. Typically 15°F - 20°F is used for this value but a higher value can be used. Note that the pump room temperature should not exceed 120°F. Also, for pump room temperatures over 77°F you must also apply the appropriate NFPA 20 BHP Derate for ambient temperature.

[4] NFPA 20 requires that the pressure drop across air inlet and outlet louvers not exceed .2" of water while flowing this total air flow. Consult a louver manufacturer to obtain pressure drop versus flow curves on specific louvers to select one that satisfies this requirement.

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Heat Exchanger Ventilation

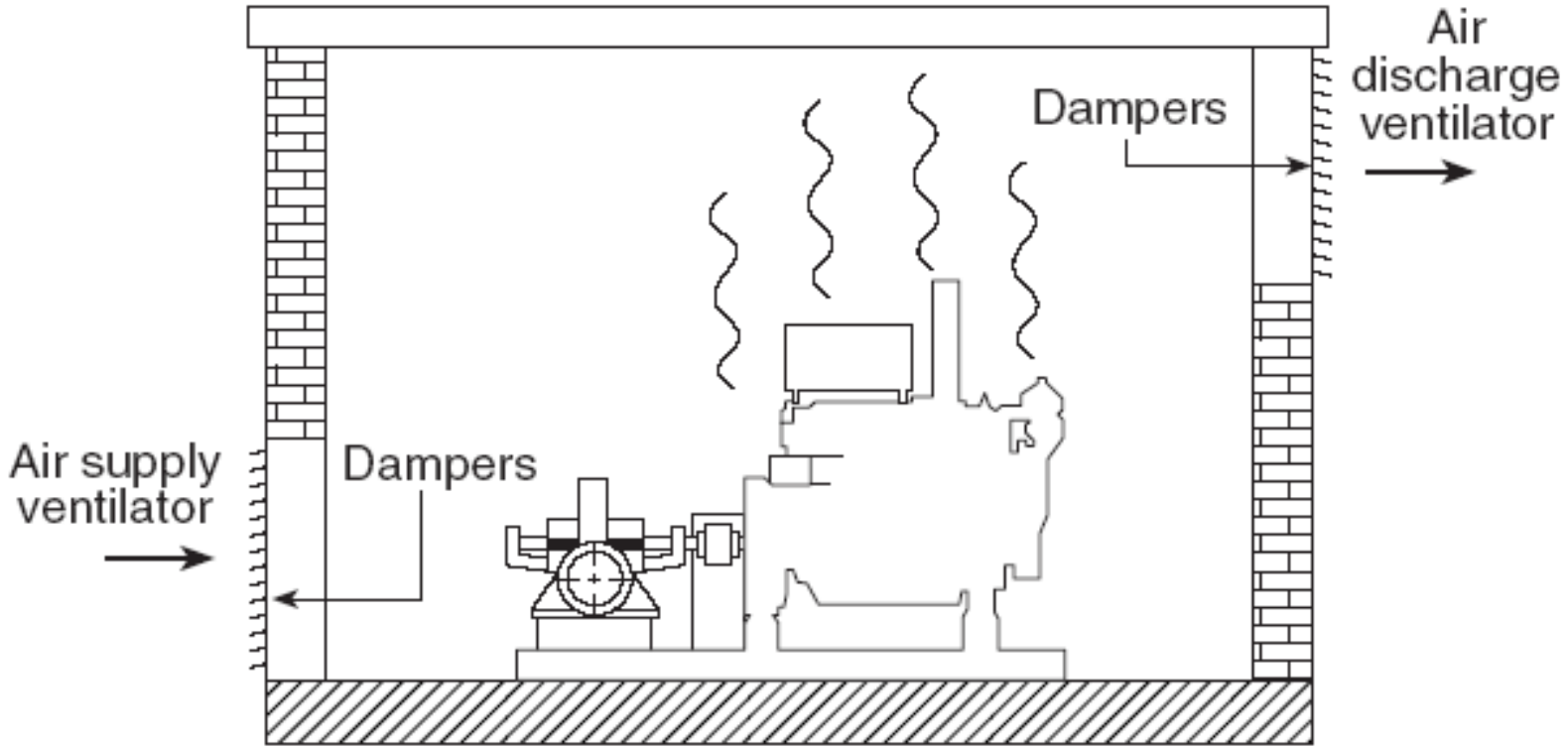


FIGURE A.11.3.2(a) Typical Ventilation System for a Heat Exchanger–Cooled Diesel-Driven Pump.

Room Requirements

- **Protection:**– Engine must be environmentally protected.
- **Access:**– Engine must have easy access from outside the building. If engine is located in the middle of a building a 2 hour fire rated passageway must be built to the pump room to protect the firemen who have to access the engine during a fire.
- **Room Temperature:** - The minimum temperature of a room is 4C(40F) and the maximum operating temperature of the room is 49C(120F) at the air inlet while the engine is running.

Room Requirements

- **Ventilation:** There must be adequate ventilation to allow for combustion and to make sure the room temperature does not get above 49C(120F).
- Use the Clarke Air Ventilation Calculator for every job to ensure you have enough air for the pump room.
- There should be both an air intake and discharge openings in a room to provide cross ventilation.

Fuel Tank

Fuel Tank Arrangement

- The fuel tank is sized for 5.07 liter/kW (1 gal/HP) plus 10% (5% for expansion and 5% for sump). (11.4.1.3.1)
- Per NFPA20 2022 11.4.1.3.1 Fuel supply tank(s) shall be sized for a minimum of 12 hours of engine run time based on the fuel supply rate requirements of the engine, plus 5% volume for expansion and 5% volume for sump.
- The fuel tank shall be reserved exclusively for the fire pump diesel engine. (11.4.1.2.1)
- There shall be one fuel tank per engine. (11.4.1.2.2)

Fuel Tank Arrangement

- The fuel tank shall be located above ground and shall not be buried. (11.4.3.1)
- The fuel tank outlet shall be located so that its opening is no lower than the level of the engine's fuel transfer pump. (11.4.3.3)
- The static head pressure limits shall not be exceeded when the level of fuel in the tank is at a maximum. (11.4.3.4)

JU6H-UF50

INSTALLATION & OPERATION DATA (I&O)

USA Produced

- Basic Engine Description
- Power Rating
- Cooling System - [CDS1127]
- Electric System - DC
- Exhaust System (Single Exhaust Outlet)
- Fuel System

Fuel Consumption - gal/hr (L/hr)	1750 - 10.7 (40.5) 2100 - 12.3 (46.6) 2350 - 12.9 (48.8)
Fuel Return - gal/hr (L/hr)	1750 - 5.8 (22) 2100 - 6.9 (26.1) 2350 - 7.9 (29.9)
Fuel Supply - gal/hr (L/hr)	1750 - 16.5 (62.5) 2100 - 19.2 (72.7) 2350 - 20.8 (78.7)
Fuel Pressure - lb/in² (kPa)	3 (20.7) - 4 (27.6)
Minimum Line Size - Supply - in.	.50 Schedule 40 Steel Pipe
Pipe Outer Diameter - in (mm)	0.868 (21.6)
Minimum Line Size - Return - in.	.375 Schedule 40 Steel Pipe
Pipe Outer Diameter - in (mm)	0.675 (17.1)
[illegible]	[illegible]
Maximum Allowable Fuel Head above Fuel pump, Supply or Return - ft (m)	4.5 (1.4)
Fuel Filter Micron Size	5

- Heater System
- Air System
- Lubrication System
- Lube Oil Heater
- Performance

NOTE: This engine is intended for indoor installation or in a weatherproof enclosure. ¹ Derate 3% per every 1000 ft. 304.8m above 300 ft. 91.4m and derate 1% for every 10°F 5.55 °C above 77°F 25°C. ² Positive and Negative Cabin Combined Length. ³ Minimum Exhaust Pipe Diameter is based on: 15 feet of pipe, one 90° elbow, and one Industrial silencer. A back pressure flow analysis must be performed on the actual field installed exhaust system to assure engine maximum allowable back pressure is not exceeded. See Exhaust Sizing Calculator on www.clarkefire.com. ( ) indicates component reference part number.

C13508 Rev V
DSP 17OCT16

DOWNLOAD PDF

Fuel Tank Arrangement

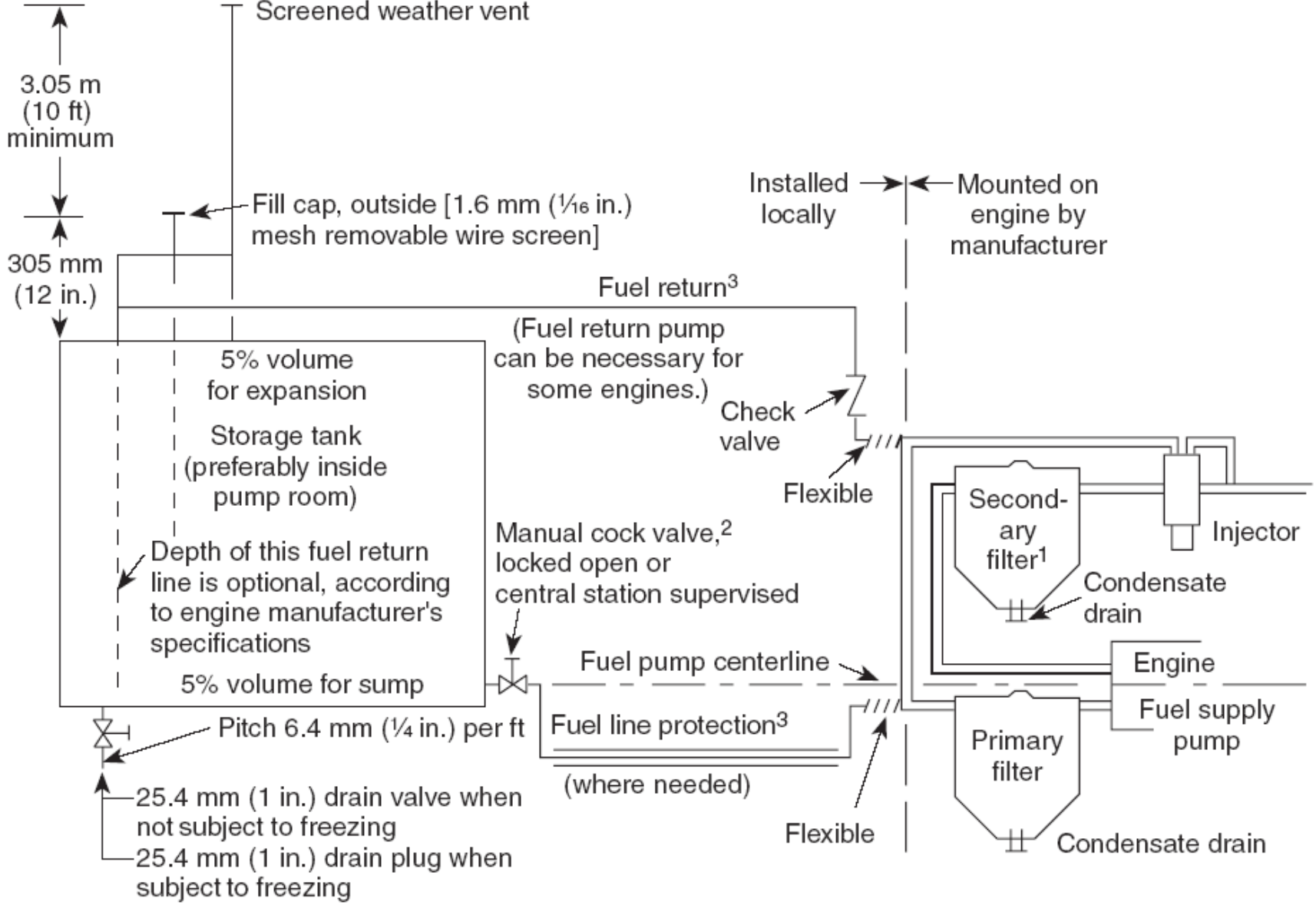
- In zones where freezing temperatures 0°C (32°F) are possible, the fuel supply tanks shall be located in the pump room. (11.4.3.2)
- The fuel storage tanks shall be kept as full as practical at all times, but never below 66% of tank capacity. A fuel level indicator shall be provided to activate at the 2/3rds tank level. (11.6.4.1)
- Bonding & grounding will be required on all metallic components, piping and equipment in the fuel supply to prevent electrostatic ignitions. (11.4.6.1)

Fuel Tank Arrangement

- The fuel supply pipe connection shall be located on the side of the tank so that 5% of the tank volume provides a sump volume not usable by the engine. (11.4.1.5.4.1&2)
- Each tank shall have an engine return connection no smaller than the fuel return piping from the engine. (11.4.1.5.5&5.1)

Fuel Arrangement

- The diesel engine must use clean #2 diesel.
- #1, blended fuel, or jet fuel have a lower cetane ratings, which reduces the power output by 10% of the engine compared with the listed power. (11.4.5.2)
- Biodiesel and other alternative fuels are not recommended for diesel engines used for fire protection because of the unknown storage life issues. (A11.4.5.1)
- A guard, pipe protection, or approved double walled pipe shall be provided for all exposed fuel lines. (11.4.4.6)



[1]Secondary filter behind or before engine fuel pump, according to engine manufacturer's specifications.
[2]Excess fuel can be returned to fuel supply pump suction, if recommended by engine manufacturer.
[3]Size fuel piping according to engine manufacturer's specifications.

FIGURE A.11.4.6 Fuel System for Diesel Engine–Driven Fire Pump.

LOCATION

- (•) USA Purchased
- ( ) UK Purchased

UNITS

- (•) English Units
- ( ) Metric Units

MARKET

- (•) UL/FM/NFPA20
- ( ) LPCB
- ( ) NL
- ( ) AP

Engine Series

C13H0
C18H0
C32H0
DP6H
DQ6H
DR8H
DS0H
DS0R
DT2H
DT2R
JU4H
JU4R
JU6H
JU6R
JW6H

Models

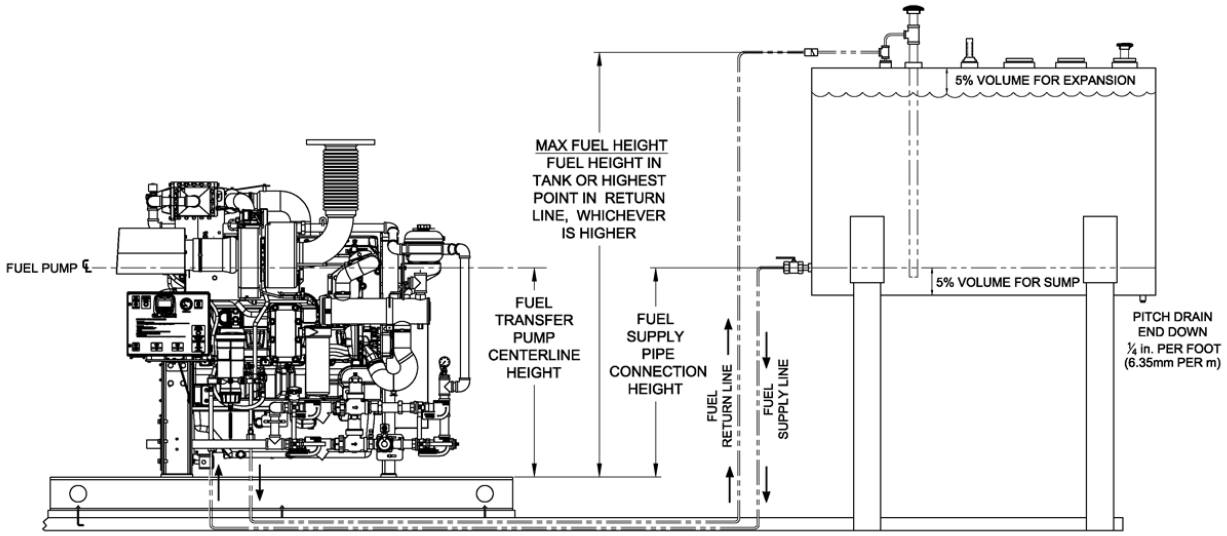
UFAA78
UFAC10
UFAC18
UFAC20
UFAC28
UFAD10
UFAD12
UFAD18
UFAD20
UFAD22
UFAD28
UFAD30
UFAD32
UFAD38
UFAD40

RPM/HP

1760 / 510 HP

* denotes obsolete models

FUEL SYSTEM SCHEMATIC



TANK DATA

Fuel Consumption (Gallons/Hour)

33

Driving Fire Protection Since 1964

CLARKE

TANK DATA

Fuel Consumption (Gallons/Hour)

33

NFPA Min. Tank Size for 12 Hour Run Time per 2022 Spec. (Gallons)

435.6

NFPA Min. Tank Size prior to 2022 Spec. (Gallons)

561

NFPA Min. Run Time (Hours)

15.5

Min. Size for 8 Hour Run Time (Gallons)

290.4

Is size of installed tank known?

- ○ Yes
- ◉ No

Actual Tank Size (Gallons)

Actual Run Time (Hours)

Notes:

- Per NFPA20 2022 11.4.1.3.1 Fuel supply tank(s) shall be sized for a minimum of 12 hours of engine run time based on the fuel supply rate requirements of the engine, plus 5% volume for expansion and 5% volume for sump.
- Per NFPA20 2022 11.4.1.3.1.1 When the fuel supply rate requirements of the engine are not known, fuel supply tank(s) shall have a capacity at least equal to 1 Gal/HP (5.07L/kW), plus 5% volume for expansion and 5% volume for sump.
- NFPA Tank Run Time = Listed Power ÷ Fuel Consumption
- Min. Size for 12 Hour Run Time = Fuel Consumption x 12 hours x 1.1
- Min. Size for 8 Hour Run Time = Fuel Consumption x 8 hours x 1.1
- Actual Tank Runtime = Actual Tank Size x 0.9 ÷ Fuel Consumption
- The fuel tank outlet shall not be lower than the fuel transfer pump
- Refer to the latest edition of NFPA 20 for all fuel tank and fuel line requirements

PRINT TANK DATA

Customer:	Job Name:	Job Number:

TANK INFORMATION

ENGINE DATA

Engine Model: C18H0-UFAD28
Engine Speed: 1760
Rated Power: 510 HP

NFPA SIZES PRIOR TO 2022

Fuel Consumption: 33 Gallons/Hour
NFPA Min. Tank Size: 561 Gallons
NFPA Min. Run Time: 15.5 Hours
Size for 8 Hour Run Time: 290.4 Gallons

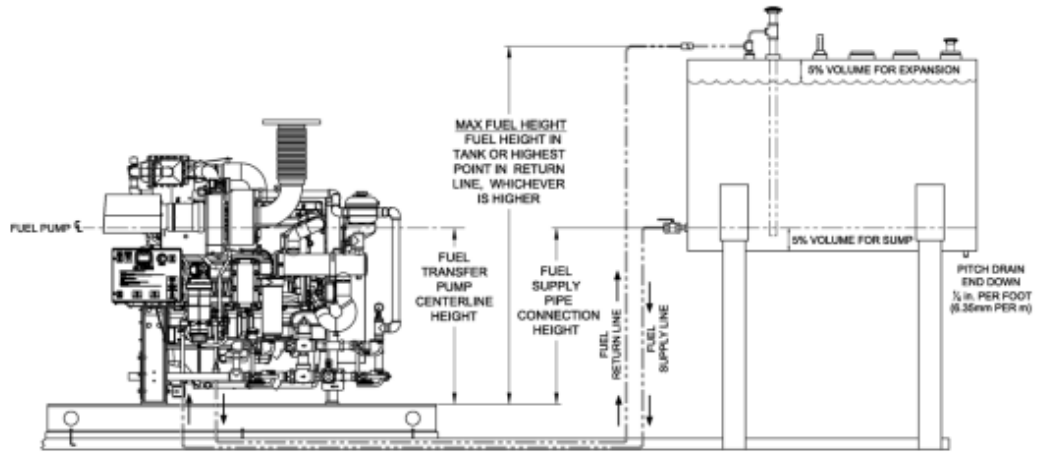
NFPA SIZES PER 2022

Fuel Consumption: 33 Gallons/Hour
NFPA Min. Tank Size: 435.6 Gallons
NFPA Min. Run Time: 15.5 Hours
Size for 12 Hour Run Time: 435.6 Gallons

ACTUAL SIZES

Actual Tank Size: 600 Gallons
Actual Run Time: 16.4 Hours

FUEL TANK LAYOUT



NOTES:

- Per NFPA20 2022 11.4.1.3.1 Fuel supply tank(s) shall be sized for a minimum of 12 hours of engine run time based on the fuel supply rate requirements of the engine, plus 5% volume for expansion and 5% volume for sump.
- Per NFPA20 2022 11.4.1.3.1.1 When the fuel supply rate requirements of the engine are not known, fuel supply tank(s) shall have a capacity at least equal to 1 Gal/HP (5.07L/kW), plus 5% volume for expansion and 5% volume for sump.
- NFPA Tank Run Time = Listed Power ÷ Fuel Consumption
- Min. Size for 12 Hour Run Time = Fuel Consumption x 12 hours x 1.1
- Min. Size for 8 Hour Run Time = Fuel Consumption x 8 hours x 1.1
- Actual Tank Runtime = Actual Tank Size x 0.9 ÷ Fuel Consumption
- The fuel tank outlet shall not be lower than the fuel transfer pump
- Refer to the latest edition of NFPA 20 for all fuel tank and fuel line requirements

Fuel Line Sizing

INSTALLATION DATA

Max Length Supply Pipe Length (Feet)	**Number of 90° Elbows**	**Number of 45° Elbows**
10	5	0
Max Length Return Pipe Length (Feet)	**Number of 90° Elbows**	**Number of 45° Elbows**
15	7	0

Fuel Supply Size (Inches)

0.75

Fuel Return Size (Inches)

0.5

Fuel Pump Centerline Height above the Engine Foot (Feet)

1.8

Fuel Supply Connection Height above the Engine Foot (Feet)

1.8

Max Fuel Height above the Engine Foot (Feet)

0

Notes:

For sizing purposes, the following design factors are included in this calculation

- The fuel return line has 7, 90 degree elbows
- The fuel supply line has 5, 90 degree elbows
- Schedule 40 pipe
- The stated length of pipe
- The fuel tank outlet shall not be lower than the fuel transfer pump
- The fuel height in tank's highest point in return

FUEL TANK & FUEL LINE - RESULTS

Customer:	Job Name:	Job Number:

TANK INFORMATION

ENGINE DATA

Engine Model: C18H0-UFAD28
Engine Speed: 1760
Rated Power: 510 HP

NFPA SIZES prior to 2022

Fuel Consumption: 33 Gallons/Hour
NFPA Min. Tank Size: 561 Gallons
NFPA Min. Run Time: 15.5 Hours
Size for 8 Hour Run Time: 290.4 Gallons

NFPA SIZES per 2022

Fuel Consumption: 33 Gallons/Hour
NFPA Min. Tank Size: 435.6 Gallons
NFPA Min. Run Time: 15.5 Hours
Size for 12 Hour Run Time: 435.6 Gallons

ACTUAL SIZES

Actual Tank Size: Unknown
Actual Run Time: Unknown

FUEL LINE INFORMATION

FUEL SUPPLY DATA

Pipe Size: 0.75 in
Pipe Length: 10 ft
90° Elbows: 5
45° Elbows: 0

FUEL RETURN DATA

Pipe Size: 0.5 in
Pipe Length: 15 ft
90° Elbows: 7
45° Elbows: 0

OUTPUT CALCULATIONS

FUEL SUPPLY CALCULATION

Engine Fuel System Pressure Loss:	0.341 ft
Fuel Piping Pressure Loss:	+ 0.192 ft
Total:	0.533 ft
Max Suction Lift:	6.961 ft

RESULTS: Supply system pressure losses are ok.

FUEL RETURN CALCULATION

Static head:	-0.01 ft
Fuel Piping Pressure Loss:	+ 0.465 ft
Total:	0.457 ft
Max Fuel Head:	15 ft

RESULTS: Return system pressure is ok.

FUEL TANK LAYOUT

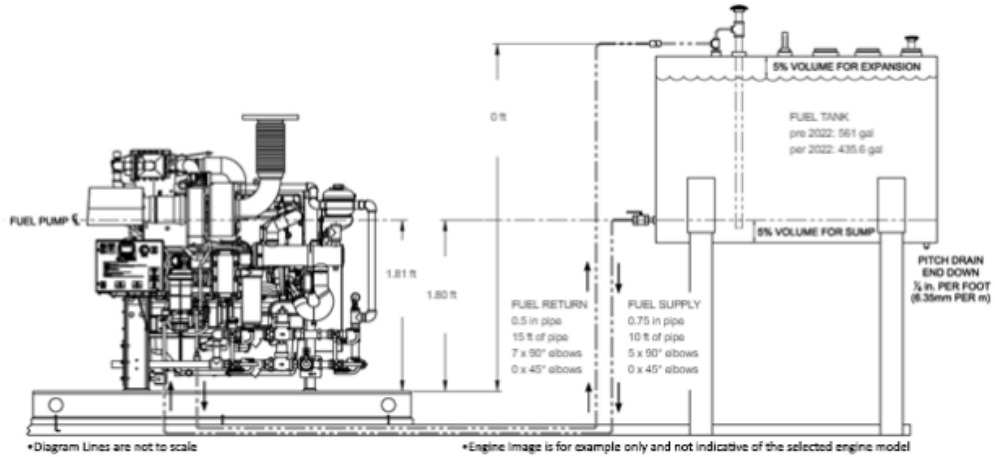


*Diagram Lines are not to scale

*Engine image is for example only and not indicative of the selected engine model

NOTES

Per NFPA20 2022 11.4.1.3.1 Fuel supply tank(s) shall be sized for a minimum of 12 hours of engine run time based on the fuel supply rate requirements of the engine, plus 5% volume for expansion and 5% volume for sump.

Per NFPA20 2022 11.4.1.3.1.1 When the fuel supply rate requirements of the engine are not known, fuel supply tank(s) shall have a capacity at least equal to 1 Gal/HP (5.07L/kW), plus 5% volume for expansion and 5% volume for sump.

Size Per NFPA (Gallons) = Listed Power x 1.1

NFPA Tank Run Time = Listed Power ÷ Fuel Consumption

Min. Size for 12 Hour Run Time = Fuel Consumption x 12 hours x 1.1

Min. Size for 8 Hour Run Time = Fuel Consumption x 8 hours x 1.1

Actual Tank Runtime = Actual Tank Size x 0.9 ÷ Fuel Consumption

- The fuel tank outlet shall not be lower than the fuel transfer pump
- Pipe pressure loss calculations based on standard schedule 40 pipe
- Fuel piping shall not be galvanized steel or copper
- For more information see Fuel Line Plumbing Schematic C132026.
- Refer to the latest edition of NFPA 20 for all fuel tank and fuel line requirements

Fuel Arrangement

- Flame-resistant reinforced flexible hose with 30 min flame resistance equal to ISO 15540 & pressure rating to 2 times the fuel supply shall be provided at the engine for connection to the fuel system piping. (11.4.4.1)
- Fuel piping shall not be galvanized steel or copper. (Recommend schedule 40 or SS pipe) (11.4.4.2)
- There shall be no shut-off in the fuel return line to the tank. (11.4.4.4)
- The grade of fuel oil shall be indicated on the fuel tank by letters that are a minimum of 152mm (6 in) in height and in contrasting color to the tank. (11.4.5.4)

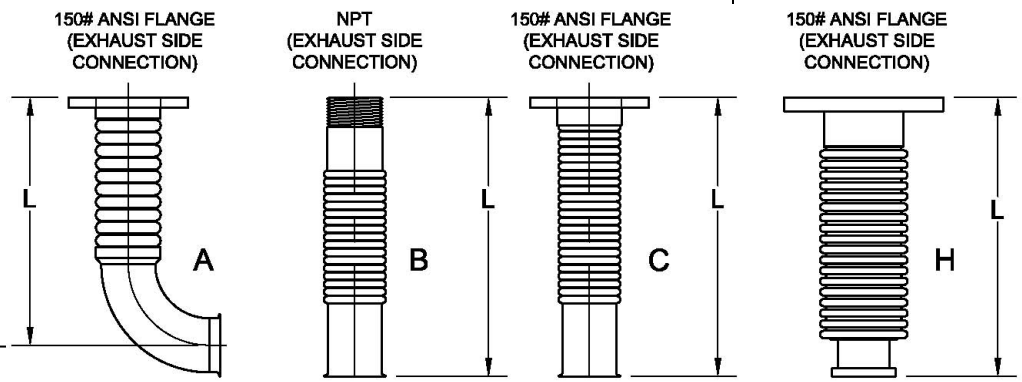
Fuel Tank

- **Fuel Lines:**
  - Use schedule 40 black pipe; never use galvanized steel or copper.
- **Fuel Type:**
  - Always use #2 diesel; stay away from Bio Diesel, Winter blend, #1 and jet fuel.

Exhaust Sizing

Engine Exhaust

- Each engine shall have an independent exhaust system. (11.5.2.1)
- A flex connector shall be used between the engine and the exhaust pipe. (11.5.2.2)
- The flex connector shall not be used for misalignment. (The purpose of the flex is to allow for thermal expansion and for isolating engine vibration from the rest of the exhaust system.)



Engine Exhaust

- Back pressure in the exhaust system shall not exceed the engine's limit. (11.5.2.5)
  - The exhaust sizing program on the Clarke website can calculate the back pressure)
- Building supported; *not* engine supported
- Insulation wrap the exhaust systems in-room components. (11.5.2.4)
- Exhaust from the engine shall be piped to a safe point outside the pump room and arranged to exclude water. (11.5.3.1)
- Exhaust emission after treatment devices that have the potential to adversely impact the performance & reliability of the engine shall not be permitted(11.5.2.9)

Exhaust Backpressure Calculator

LOCATION

- (•) USA Purchased
- ( ) UK Purchased

UNITS

- (•) English Units
- ( ) Metric Units

MARKET

- (•) UL/PMI/NFPA20
- ( ) LPCB
- ( ) NL
- ( ) AP

Engine Series

DDFP
DP8H
DQ8H
DR8H
DS0H
DS0R
DT2H
DT2R
IK6H
IK6R
JDFP
JU4H
JU4R
JU6H
JU6R

Models

UF30
UF32
UF34
UF50
UF52
UF54
UF58
UF60
UF62
UF68 *
UF64
UFAAPG
UFAAQ8
UFAARG
UFAAS0

RPM/HP

1470 / 138HP
1760 / 183HP
2100 / 210HP
2350 / 210HP
2600 / 210HP

* denotes obsolete models

EXHAUST PIPING DATA

Pipe Size:
6"

Number 90° Elbow:
5

Number 45° Elbow:
0

Straight Pipe (Feet):
50

SILENCER TYPE

- ( ) Critical
- ( ) Hospital
- ( ) Industrial
- (•) Residential
- ( ) None
- ( ) Non Clarke

Silencer

6" Residential, P/N 00C06533, 150# Flange
6" Residential, P/N 00C06534, 150# Flange
8" Residential, P/N 00C06535, 150# Flange
10" Residential, P/N 00C06536, 150# Flange

SILENCER CONFIG

- (•) End In, End Out
- ( ) Side In, End Out
- ( ) Side In, Side Out

APPLICATION DATA

Customer:

Job Name:

Job Number:

Input By:

PUMP ROOM DESIGN TOOL

ENGINE SELECTION CALCULATOR
COOLING LOOP CALCULATOR
EXHAUST BACKPRESSURE CALCULATOR
PUMP ROOM VENTILATION CALCULATOR
DIESEL FUEL LINE SIZING FORM
PLB CALCULATOR
SPLB CALCULATOR
WATER TEMPERATURE RISE CALCULATOR
PLB RECALL
COOLING LOOP RECALL

Exhaust Backpressure Calculator

HOME / PUMP ROOM DESIGN TOOL / EXHAUST BACKPRESSURE CALCULATOR

Results

ENGINE DATA

Manufacturer: Clarke
Engine Model: JU6H-UF50
Engine RPM: 2100
Engine HP: 210

DRAWING



BACKPRESSURE CALCULATIONS (INCHES WATER)

12.3 Pipe
\+ 7.6 Silencer (see note 1)
19.9 Total
30.0 Maximum Allowable Backpressure
Result: Total backpressure is within limits

1) CAUTION: Silencer Backpressure is based upon a Clarke USA provided Silencer. Actual Silencer Backpressure will vary depending upon the actual Silencer used (manufacturer, size, type and model). If the total Backpressure from the pipe, Silencer and orifice plate (if required) is close to the engine Maximum Allowed Backpressure, it is highly recommended you obtain the actual Backpressure (for the engine exhaust flow given above) on the Silencer being used and then confirm that the total Backpressure is still under the Maximum Allowed Backpressure.
2) Schedule 40 pipe used in calculations
3) All pipe sizes and lengths are in inches and feet.

Print

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EXHAUST BACKPRESSURE CALCULATOR - RESULTS

CALCULATIONS MADE 03/06/2018

INPUT DATA

Engine Data	Piping Data	Silencer Data
Manufacturer: Clarke	Pipe Size: 5	Manufacturer: Clarke USA
Engine Model: JU6H-UF50	Number 90° elbows: 5	Pipe Size: 5"
Engine RPM: 2100	Number 45° elbows: 0	Model: 00C06533
Engine HP: 210	Straight Pipe(Feet): 50	Application: Residential
		Connection: 150# Flange

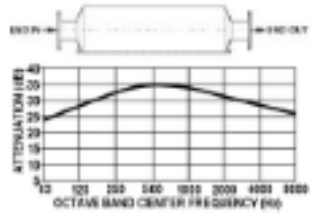
OUTPUT DATA

Exh Flow (CFM): 1,204

Temperature (°F): 1,034.0

Max Backpressure (inches water): 30

Min Backpressure (inches water): 0



EXHAUST PIPE RECOMMENDATIONS

BACKPRESSURE CALCULATIONS (INCHES WATER)

12.3 Pipe

\+ 7.6 Silencer (see note 1)

19.9 Total

30.0 Maximum Allowable Backpressure

Result: Total backpressure is within limits

1) CAUTION: Silencer Backpressure is based upon a Clarke USA provided Silencer. Actual Silencer Backpressure will vary depending upon the actual Silencer used (manufacturer, size, type and model). If the total Backpressure from the pipe, Silencer and orifice plate (if required) is close to the engine Maximum Allowed Backpressure, it is highly recommended you obtain the actual Backpressure (for the engine exhaust flow given above) on the Silencer being used and then confirm that the total Backpressure is still under the Maximum Allowed Backpressure.

2) Schedule 40 pipe used in calculations

3) All pipe sizes and lengths are in inches and feet.

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Exhaust

- **Exhaust Piping:**– Shall be support by the building; no weight on the engine.
- **Exhaust Protection:** Wrap the pipe with insulation to prevent burns and to stop the exhaust from heating up the room.
- **Calculator:**– Run the Clarke Exhaust Sizing program for every quote to ensure the exhaust diameter is large enough for the length of pipe and the type of muffler used.

Variable Speed Diesel -
PLD (Pressure Limiting Driver)

PLD (Pressure Limiting Driver)

- Pressure is squared to rpm
- The PLD reduces engine speed to limit pump pressure.
- Three versions available:
  - PLD-D – Discharge Control - Limits the maximum discharge pressure from a pump.
  - PLD-S – Suction Control - Limits the minimum suction pressure to the pump.
  - PLD-DS – Discharge and Suction Control – Limits both the maximum discharge pressure and minimum suction pressure for a pump.

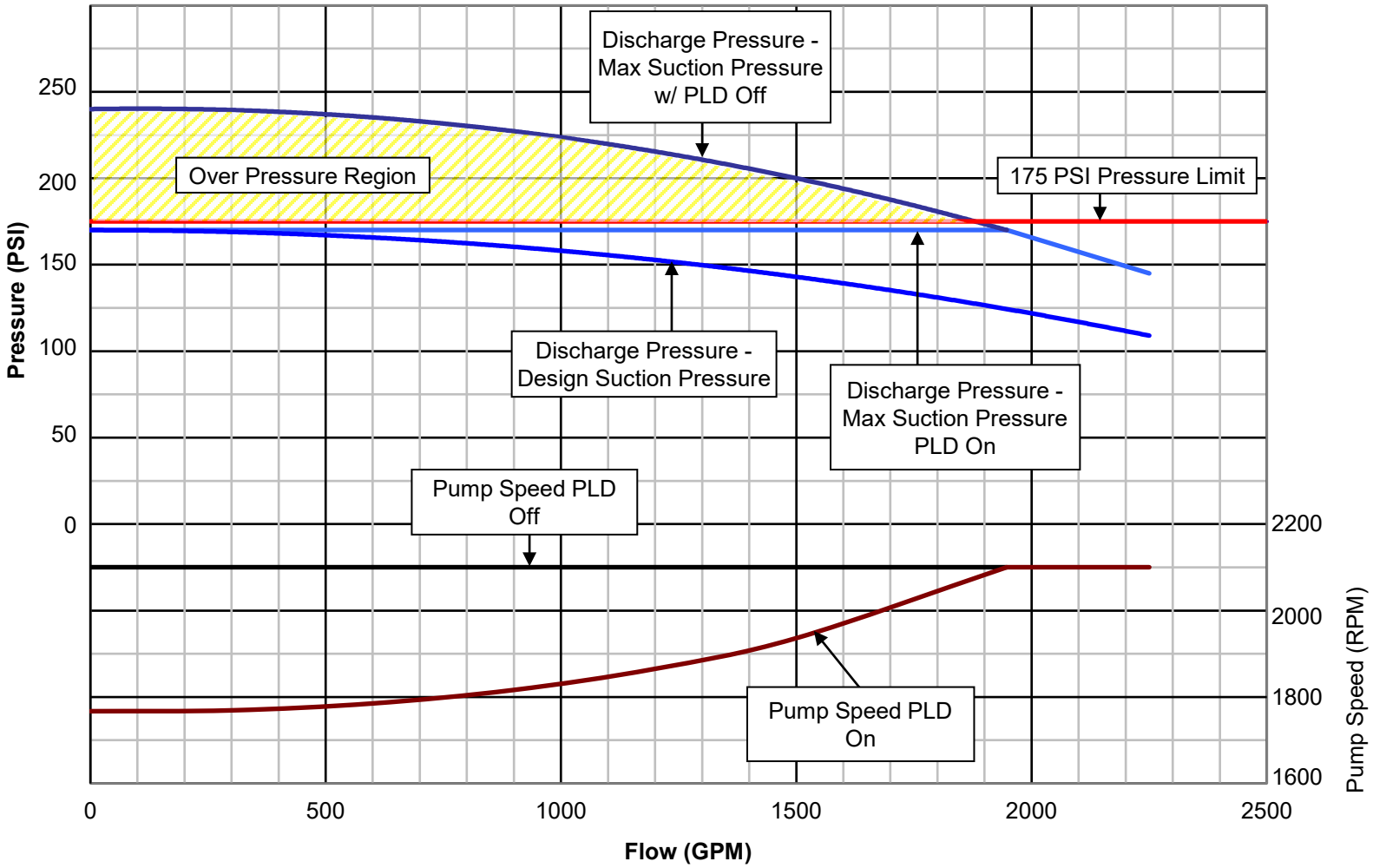
PLD-D Discharge Control

- PLD-D can be factory set to limit the maximum discharge pressure between 100 psi to 350 psi. Typically the PLD-D is set for 175 psi to protect standard rated sprinkler pipe.
- PLD-D uses a sensing line installed between the pump discharge and isolation valve to monitor the discharge pressure from the pump.
- PLD Calculator must be run in order to determine if the engine can slow down enough for the required pressure limiting.

PLD-D Discharge Control

- For the PLD-D all pump components, up to the isolation valve, need to be rated for 240 psi since during commissioning the pump has to be tested both with and without PLD operating.
- A pressure relief valve is required incase the PLD fails and pump pressure needs to be reduced.
- The PLD-D device is located in the engine instrument panel and uses a standard diesel controller and requires one additional alarm for system overpressure exceeding 115%.

Typical System Performance W/ Pressure Limiting Driver (PLD)
Typical Pump Performance - 1500 GPM, 125PSI, 2100 RPM
Complete System



PLD-S Suction Control

- PLD-S can be factory set between 5 psi to 30 psi to limit the incoming minimum suction pressure. Used to prevent the suction pipe from collapsing from high flow and low pressure.
- PLD-S uses a sensing line installed before the pump inlet to monitor the incoming pressure.
- PLD-S Calculator must be run in order to determine if the engine can slow down enough for the required pressure limiting.

System Operations

Torsional Coupling

- For vertical turbine pumps, using right-angle gear drives driven by a diesel engine, a listed torsional coupling shall be used and mounted on the engine side of the driveshaft. (7.5.1.6.1)
- The pump manufacturer shall provide a 3 mass torsional frequency calculation to ensure there are no critical speeds within 25% above and below the operating speed of the pump and drive. (7.5.1.6.1.1)

System Operation

- Engines shall be started no less than once a week and run for no less than 30 minutes. (11.6.1.1)
- The fire pump shall be started and brought up to rated speed without interruption within 20 seconds. (11.2.4.1.4)
- Means shall be provided for qualified personnel to determine that the fire pump is operating in a satisfactory manner during pump operation (4.3.1)

Electric Motors and Gen Sets

Electric Motors/Gen Sets

- An electric motor driven fire pump shall be provided with a normal source of power as a continually available source. (9.2.1)
- At least on alternate source of power shall be provided where the normal source is not reliable 9.3.2 unless there is a back up engine driven fire pump (9.3.3)

Electric Motors/Gen Sets

- A reliable power source possesses: (A9.3.2)
  - No shutdowns longer than 10 continuous hours in the year prior to plan submittal.
  - Power outages have not been routinely been experienced in the area of the protected facility caused by failures in generation or transmission.
  - The normal source of power is not supplied by overhead conductors outside the protected facility. Overhead lines are cut and deenergized for fire department operations.

Electric Motors/Gen Sets

- Where on-site gen sets are used to supply power to fire pump motors, there shall be of sufficient capacity to allow normal starting & running of the motor while supplying all other simultaneously operated loads. (9.6.1.1).
- The generator shall run & continue to produce rated nameplate power without shutdown or derate for alarms & warnings or failed engine sensors, except for overspeed shutdown. (9.6.2.2)
- The generator fuel tank shall be sized for 8 hours of fire pump operation at 100% in addition to the supply required for other demands. (9.6.23.3)

Clarke Website - www.clarkefire.com

- Current Models
- Installation & Operation Data
- Emission Data
- Exhaust Sizing
- Operations Manual
- Spare Parts Illustration
- Installation Checklist
- Power Curves
- Installation Drawings
- Contact List
- Wiring Diagrams
- Technical Manual
- Service Dealer Directory
- Startup and Warranty Forms

Download Engine Application Presentation

