Product Change Notification

FM1333

Cooling Loop Sizing Requirements & New Alarm Sensors

Compliance Required By April 1st 2015
1. Why is this change taking place?

2. How will our engines be changing?

3. How will these changes affect our customers?

4. New instrument panel wiring terminals

5. New cooling loop sizing requirements

6. Introducing the new Clarke cooling loop calculator

In order to comply with the new FM1333 standard, Clarke implemented 5 key changes to our UL-FM drivers as of 30th November 2013.

The following changes were communicated to customers at that time:

1. **FM Re-Examination**
   All Clarke FM Approved engines were re-examined to confirm their compliance to the latest FM Approvals Standard Class 1333.

2. **FM Standard-3.6.1 H**
   We replaced required raw water hoses to meet ISO 15540.

3. **FM Standard-3.3.17**
   We developed a manual start override procedure in the event of a microprocessor not functioning.

4. **FM Standard-3.15.2**
   We developed an automatic ECM switch for all of our electronic engines.

5. **FM Standard-3.6.1 A**
   We gained FM Approval for our full cooling loop range.

**1st April 2015**

In addition to the previously implemented 5 changes, the revised FM 1333 standard also outlined new requirements for both the functionality and sizing of raw water cooling loops for the control of raw water flow to liquid cooled (heat exchanger) diesel fire pump drivers.

Due to the complexity and compatibility challenges of these revised requirements, the compliance date set by FM Global was April 1st 2015.

On the following pages, we will look at the new changes in more detail.
How will our engines be changing?

NEW COOLING LOOP ALARM SENSORS

1

FM Standard 3.6.1 F (Low Raw Water Flow Alarm)

“A means shall be provided to alarm a clogged strainer condition to the fire pump controller on Terminal 311. The signal shall be of battery negative type. This could be a flow sensor, differential pressure sensor, or other sensor. The alarm shall not function when the engine is not running, but is intended to alarm during weekly tests or fire conditions. The alarm threshold shall be set at 75 percent of the required cooling water flow.” (extract of FM1333)

CLARKE ACTION

UL-FM engines shipping from Clarke after April 1, 2015 will have two pressure sensors installed.

The first sensor will be installed after the pressure regulator, before the solenoid valve, on the automatic cooling loop line. The second sensor will be installed after the heat exchanger on the outlet pipe work.

The low raw water flow sensor will be set to alarm at 90% of the minimum flow value required at 100°F (37°C) for each specific Clarke engine model.

2

FM Standard 3.6.1 G (High Raw Water Temp Alarm)

“A raw water high temperature switch or sensor shall be provided to monitor the inlet temperature to the primary or secondary cooling device. The high temperature alarm shall activate at a temperature chosen by the engine manufacture to ensure adequate cooling at elevated pump discharge temperatures. The set point shall be chosen so that the raw water high temperature alarm will activate before the engine overheats and activates the high engine temperature alarm on Terminal 5. A high raw water temperature alarm (battery negative signal) shall be provided to the controller on Terminal 310.” (extract of FM1333)

CLARKE ACTION

UL-FM engines shipping from Clarke after April 1, 2015 will have a temperature switch fitted on the pipe work between the cooling loop and the engine heat exchanger.

The high raw water temperature switch is set to alarm at 105°F (40°C)
How will our engines be changing?

**CLARKE USA**
Manufactured Engines

UL-FM engines shipping from Clarke USA after April 1st 2015 will be supplied with three new components installed in the cooling system.

The image to the right gives an indication of where the new components will be installed in the cooling system.

Please Note: The location of the new components will vary slightly for each model series.

**CLARKE UK**
Manufactured Engines

UL-FM engines shipping from Clarke UK after April 1st 2015 will be supplied with three new components installed in the cooling system.

The image to the right gives an indication of where the new components will be installed in the cooling system.

Please Note: The location of the new components will vary slightly for each model series.
New changes to UL-FM Engine Instrument Panel Terminals

With the addition of the new Low Raw Water Flow and High Raw Water Temperature alarms, Clarke will be installing an additional wiring loom which will connect these new alarms to the engine instrument panel via our Low Flow Alarm Board (LFAB).

The LFAB will be mounted on the engine and will monitor the feedback signals from both pressure sensors, as well as the temperature switch.

If an alarm condition should occur, the LFAB will provide an alarm signal to the engine instrument panel, which will then activate an alarm on the fire pump controller.

As these alarms are new, we have revised the design of all UL-FM Engine Instrument Panel Wiring Terminals, with the addition of the following two new alarms:

#310 - High Raw Water Temperature Alarm

#311 - Low Raw Water Flow Alarm

Revised UL-FM Engine Wiring Diagrams

In line with the new terminals we have added to our UL-FM engine instrument panels, we have published revised wiring diagrams for all UL-FM engine models:

- Mechanical ETS (Energized To Stop) MECAB with new cooling loop alarms - C072145
- Mechanical ETR (Energized To Run) MECAB with new cooling loop alarms - C072128
- Electronic engine with new cooling loop alarms - C072146

Requirement For Customers To Revise Their UL-FM Wiring Harnesses

In conjunction with Clarke installing these new alarms sensors in order to meet FM Globals compliance requirement date of April 1st 2015, Fire Pump Controller OEM’s have also been requested by FM Global to revise thier controller design in order to accept these new alarm requirements.

The compliance date for FM Approved controllers shall be advised separately by FM Global or the controller OEMs.

Due to this, any customer who currently manufactures or sources their own design of inter-connecting harness between our engine instrument panel and the automatic fire pump controller will have to revise thier harness design to incorporate two new wires for alarm terminals #310 & #311.

The standard recommended wire gauge for these new alarms is stranded #14 (2.2mm)
### Energized To Stop (ETS)

#### Mechanical Engines

<table>
<thead>
<tr>
<th>1</th>
<th>Water Solenoid Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Engine Run Signal</td>
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<tr>
<td>3</td>
<td>Overspeed Signal</td>
</tr>
<tr>
<td>4</td>
<td>Low Oil Pressure Signal</td>
</tr>
<tr>
<td>5</td>
<td>High Engine Water Temp Signal</td>
</tr>
<tr>
<td>6</td>
<td>Battery #1 Input (+)</td>
</tr>
<tr>
<td>8</td>
<td>Battery #2 Input (+)</td>
</tr>
<tr>
<td>9</td>
<td>Battery #1 Crank Signal</td>
</tr>
<tr>
<td>10</td>
<td>Battery #2 Crank Signal</td>
</tr>
<tr>
<td>11</td>
<td>Battery Negatives (-)</td>
</tr>
<tr>
<td>12</td>
<td>Fuel Solenoid Signal (ETS ONLY)</td>
</tr>
<tr>
<td>310</td>
<td>High Raw Water Temp</td>
</tr>
<tr>
<td>311</td>
<td>Low Raw Water Flow</td>
</tr>
<tr>
<td>312</td>
<td>Low Engine Water Temp Signal</td>
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### Energized To Run (ETR)

#### Mechanical Engines

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<tr>
<th>1</th>
<th>Fuel &amp; Water Solenoid Signal</th>
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<tbody>
<tr>
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<td>Battery #1 Input (+)</td>
</tr>
<tr>
<td>8</td>
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</tr>
<tr>
<td>9</td>
<td>Battery #1 Crank Signal</td>
</tr>
<tr>
<td>10</td>
<td>Battery #2 Crank Signal</td>
</tr>
<tr>
<td>11</td>
<td>Battery Negatives (-)</td>
</tr>
<tr>
<td>12</td>
<td>** NOT USED ON ETR **</td>
</tr>
<tr>
<td>310</td>
<td>High Raw Water Temp</td>
</tr>
<tr>
<td>311</td>
<td>Low Raw Water Flow</td>
</tr>
<tr>
<td>312</td>
<td>Low Engine Water Temp Signal</td>
</tr>
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</table>

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### Electronic Engines

<table>
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<th>Fuel &amp; Water Solenoid Signal</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Engine Run Signal</td>
</tr>
<tr>
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<tr>
<td>4</td>
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<td>5</td>
<td>High Engine Water Temp Signal</td>
</tr>
<tr>
<td>6</td>
<td>Battery #1 Input (+)</td>
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<td>8</td>
<td>Battery #2 Input (+)</td>
</tr>
<tr>
<td>9</td>
<td>Battery #1 Crank Signal</td>
</tr>
<tr>
<td>10</td>
<td>Battery #2 Crank Signal</td>
</tr>
<tr>
<td>11</td>
<td>Battery Negatives (-)</td>
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<tr>
<td>301</td>
<td>Alternate ECM Operating</td>
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<tr>
<td>302</td>
<td>Fuel System Failure</td>
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<tr>
<td>303</td>
<td>Primary ECM Failure</td>
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<td>304</td>
<td>Dual ECM Failure</td>
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<tr>
<td>310</td>
<td>High Raw Water Temp</td>
</tr>
<tr>
<td>311</td>
<td>Low Raw Water Flow</td>
</tr>
<tr>
<td>312</td>
<td>Low Engine Water Temp Signal</td>
</tr>
</tbody>
</table>
Pump OEM’s/Dealers Responsibility

Effective immediately, pump manufacturers are responsible for ensuring site specific installation conditions do not exceed the below standard cooling loop sizing assumptions; or for verifying that the cooling loop is properly sized based on the known installation conditions; or for providing site specific conditions to Clarke at the time of placing an order.

Standard Cooling Loop Sizing Conditions

As of January 1st 2015, Clarke cooling loops are sized for each engine model based on the following standard conditions:

- 100°F (38°C) Raw Water Temperature
- 80 psi (5.5 bar) Inlet Pressure
- 60 psi (4.1 bar) Pressure Regulator Setting
- 10 psi (0.7 bar) Residual Pressure at the outlet of the heat exchanger

Note: Our standard cooling loop is galvanized and rated up to 250 psi.

Non Standard Cooling Loop Sizing Conditions

Applications that exceed the standard cooling loop sizing conditions can be reviewed using either one of the two below methods:

1. Clarke Cooling Loop Calculator via www.clarkefire.com
2. Submitting a cooling loop review form to Clarke
   (Completed forms to be sent to Donna Penter dpenter@clarkefire.com)

After reviewing the site specific conditions, Clarke will advise if the standard sized cooling loop, for the given engine model, remains acceptable for the application.

Alternatively, Clarke will advise that the cooling loop size must be increased in order to take into consideration the additional pressure and flow requirements of the specific installation site.
Introducing the new Clarke Cooling Loop Calculator

Accessing The New Clarke Cooling Loop Calculator

Our new cooling loop calculator can be located via the following:

1) Log on to www.clarkefire.com
2) Select “Application Calculators” Menu
3) Select “Cooling Loop Calculator” Tab

You can also click on the following link to go directly to the calculator:
Introducing the new Clarke Cooling Loop Calculator

The 5 Steps To Review An Installation Cooling Loop Size

1. Select which Clarke facility will manufacture your engine: Clarke USA or Clarke UK
   Select your preferred unit of measurement: English (°F, psi & ft) or Metric (°C, kPa & m)
   Select the specific engine model: I.e. JU6H-UF84 3000 PRM / 275 HP

2. Select your cooling loop material of construction: I.e. Galvanized, Sea Water etc
   Select your application pump design: HSC/End Suction or Vertical Turbine

3. Enter your raw water supply inlet temperature: I.e. 110°F
   Select your suction supply: City Water Main or Ground Storage Tank
   Enter residual suction pressure at 150% flow condition: I.e. 5 psi (Storage Tank)
   Enter pump pressure at 150% flow condition: I.e. 80 psi
   Select where the heat exchanger outlet water is going: To Floor Drain or To Storage Tank
   Enter storage tank elevation if water is being returned to tank: I.e. 10 ft
Enter length of pipe after heat exchanger outlet: I.e. 25 ft

Enter number of 90° elbow joints after the heat exchanger outlet: I.e. 9

After entering all data, click “See Results”.

**ACCEPTABLE RESULT**

Subject to the installation specific conditions being considered to remain acceptable, The calculator will confirm that the “**Standard loop size is acceptable**”, for the selected engine model and will provide suitable flow & pressure for the application.

Please Note: Subject to installation specific conditions, the results page may still recommend that the heat exchanger outlet pipe size be increased by an additional size in order to allow sufficient flow.
**UNACCEPTABLE RESULT**

Subject to installation specific conditions being considered to exceed the standard loop size conditions, the calculator will recommend an alternative increased loop size for the application and it will state:

“*Must use required loop size, log number xxxxx assigned*”

The log number is very important, for applications where an increased size cooling loop is required, customers must advise Clarke of this log number and where possible include a print out of the cooling loop calculator result page when submitting the purchase order for this engine. (shown on next page)

(The above unacceptable example is based on installation conditions that exceed the standard sized loop conditions)
### Example Increased Cooling Loop Size Requirement Log Form

(To Be Submitted With Customer Purchase Order)

**CLARKE**

**Fire Protection Products, Inc.**

**Cooling Loop Selection**

<table>
<thead>
<tr>
<th>Engine</th>
<th>Model</th>
<th>JU4H-UF24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump And System</td>
<td>Loop Material: Galvanized</td>
<td>Pump Type: HSC or End Suction</td>
</tr>
<tr>
<td></td>
<td>Raw Water Inlet Temp (°F): 120</td>
<td>Suction Supply Pressure (Residual) at 150% flow: 30 psi</td>
</tr>
<tr>
<td></td>
<td>Suction Supply: Ground Storage Tank</td>
<td>Pump Pressure at 150% flow: 30 psi (cooling loop inlet pressure)</td>
</tr>
<tr>
<td></td>
<td>Total Discharge Pressure at 150% flow: 30 psi</td>
<td>Return Water: Storage Tank</td>
</tr>
<tr>
<td></td>
<td>Elevation (ft): 165</td>
<td></td>
</tr>
</tbody>
</table>

**Outlet Piping**

- Horizontal and Vertical Straight Pipe (ft): 170
- Number of 90° Elbows: 45

**Application**

- Customer: Big Red Fire Pumps LTD
- Job Name: Example 2
- Job Number: 2
- Run By: Ross Livingston

**Results**

- Required Loop Size: 75" x 75" x 75"
- Heat Exchanger Minimum Outlet Pipe Size: 2 1/2"
- Standard Loop Size: 3 1/2"

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*(1) WARNING: The raw water supply outlet temperature was calculated from a linear extrapolation of minimum raw water flow rate data at 60°F and 100°F, and therefore is an estimate only. Also, the linear extrapolated minimum raw water flow rate may require the use of a larger size cooling loop. *(2) Elevation value determines the static backpressure. *(3) The value input for pipe length must include the total of all horizontal and vertical pipe lengths. *(4) Heat exchanger outlet piping increased two sizes from the cooling loop. This is due to conditions in NFPA 20 section 11.2.8.7.4. *(5) When the waste outlet piping is longer than 15 ft (4.6m) and/or its outlet discharges are more than 4 ft (1.2m) higher than the heat exchanger, the pipe size shall be increased by at least one size. *(6) 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 Calculated Cooling Loop size (stated above) is acceptable because the specific engine model minimum raw water flow requirement (green vertical line) is less than the flow rate at the intersection point, i.e., "O". Note the engine model raw water flowrate is necessary to keep the engine from overheating.

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