VEHICLE FIRE SUPPRESSION SYSTEM

Fluorine Free Foam

Maintenance Manual
PRE-FACE

Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Summary of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Original</td>
</tr>
<tr>
<td>1.2</td>
<td>Reduced low cylinder pressure switch from 1600kPa to 1550kPa.</td>
</tr>
</tbody>
</table>

This manual is an uncontrolled document. Chubb Fire & Security Pty Ltd ("Chubb") reserves the right to alter this manual at any time in accordance with our policy of continuous development. Chubb welcomes feedback regarding this manual and associated equipment.

For further information or feedback, contact Chubb on 13 15 98.
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About This Manual

This manual is written for those who maintain PEFS F3 Vehicle Fire Suppression Systems (“PEFS F3”). It contains maintenance information for the system. While reasonable care has been used in the preparation of this manual, Chubb Fire & Security Pty Limited (“Chubb”) does not represent or warrant that the information and data contained in this manual is complete, accurate or up-to-date. Chubb reserves the right to make changes to the manual at any time without notice.

PEFS F3 Systems are to be designed, installed, commissioned, inspected, maintained, and tested only by qualified, trained personnel.

IMPORTANT

No part of this publication may be distributed, reproduced, modified, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, or otherwise without the prior written approval of Chubb.

Warranty

Chubb warrants to the original system purchaser (“Customer”) that each new PEFS F3 system is free from defects in material and workmanship under normal use for a period of twelve (12) months from the date of commissioning. This warranty does not cover any fault, damage or malfunction resulting from:

- a party’s negligence, fault, misuse, abuse, neglect (including lack of or improper maintenance) or incorrect use of the PEFS F3 System;
- fair wear and tear;
- replacement of consumables;
- modification of the PEFS F3 System after it has been installed and commissioned;
- modification of the use, condition and environment of the PEFS F3 System after it has been installed and commissioned;
- use, alteration, repair or maintenance by any party that is not suitably authorised, trained and qualified; or
- vandalism, fire, water, accidental damage, power surge or any other circumstance or event outside of Chubb’s control.

This warranty is conditional upon documented evidence of proper maintenance, performed in accordance with the PEFS F3 Owner’s Manual and Maintenance Manual by authorised, qualified and trained personnel, using replacement parts that conform to original design specifications.

Where Chubb breaches its obligations under this warranty, Chubb may in its sole direction elect to re-supply the PEFS F3 System, or to replace or repair the PEFS F3 System.

To the extent permitted by law, Chubb will have no liability for any statements, representations, guarantees, conditions or warranties not expressly stated in writing by Chubb.

Consumer Guarantees

Nothing in this warranty excludes, restricts or modifies the application of the provisions of any statute (including the Competition and Consumer Act 2010 (Cth) and the Australian Consumer Law contained therein) where to do so would contravene that statute or cause any part of this warranty to be void. If the Customer is a “consumer” as defined in the Australian Consumer Law, the following provisions will apply.

Chubb’s products and services come with guarantees that cannot be excluded under the Australian Consumer Law. If the PEFS F3 System is believed to be defective, the Customer must notify Chubb as soon as possible and provide a detailed explanation of the problem.

The Customer is entitled to a replacement or refund for a major failure and to compensation for any other reasonably foreseeable loss or damage. The Customer is also entitled to have the PEFS F3 System repaired or replaced if the PEFS F3 System fails to be of acceptable quality and the failure does not amount to a major failure. Chubb reserves the right to replace any PEFS F3 System under warranty with a new, refurbished or remanufactured PEFS F3 System.

If Chubb elects to repair the PEFS F3 System:

- goods presented for repair may be replaced by refurbished goods of the same type rather than being repaired. Refurbished parts may be used to repair the goods; and
- if the goods are capable of retaining user-generated data, the repair of the goods may result in the loss of the data.

The benefits given to the Customer under this warranty are in addition to other rights and remedies the Customer has under the Australian Consumer Law and other laws applicable to the products and services. This warranty is provided by Chubb Fire & Security Pty Ltd.

**Intended use**

The PEFS F3 Foam System is a fire suppression system, installed as part of an overall fire risk reduction strategy, as defined in the fire system specifications and or risk assessment outcomes. As such, it is designed to suppress a fire occurring in the specified risk area only within the documented coverage area of each installed nozzle.
Introduction

Mining, Off-Road, Forestry and Construction equipment operating in harsh outdoor environments can be subjected at any time to the threat of fire, which may spread rapidly through the equipment endangering life and resulting in damage to major capital equipment and loss of production. The installation of a fire detection and suppression system is essential to minimise the risk to both operator and equipment.

PEFS F3 is a pre-engineered aspirating foam spray suppression system designed specifically to cope with the harsh operating conditions experienced by mobile and transportable equipment. PEFS F3 systems consist of pressurised cylinders containing fluorine free foam solution, actuation devices to initiate discharge and a discharge network containing aspirating spray nozzles to direct the foam spray on the hazard. PEFS F3 systems may be configured for both manual and automatic operation.

PEFS F3 systems offer impressive fire suppression capabilities using fluorine free foam through specially designed naturally aspirating spray nozzles that generate an improved foam application over standard foam spray systems. Strategically positioned nozzles direct the aspirated foam spray and provide “three-dimensional” firefighting properties, allowing the system to suppress pressure fires such as might occur from a ruptured fuel or hydraulic line. The air aspirated droplets of foam are extremely efficient at absorbing large amounts of heat and turn to steam which further enhances the three-dimensional firefighting properties of the PEFS F3 system.
MAINTENANCE

General

The following maintenance schedule is a guide and sets out minimum requirements only. All maintenance carried out on the PEFS F3 system should be carried out in accordance with this manual and Australia Standard AS5062. In all cases, local conditions where the system is installed should be taken into consideration when setting maintenance frequencies. For example, in harsh environments the yearly service may need to be carried out every 6 months.

Precautions

Prior to commencing any service activity, the following precautions shall be carried out as applicable:

(a) Inform the owner or agent that service is to be carried out.
(b) Where the system may be temporarily impaired, advise the responsible entity of the nature and expected duration of the impairment.
(c) On equipment that is remotely monitored, advise the monitoring service provider where service activities may cause a signal to be transmitted.
(d) Disable the system to prevent testing or other service activities from causing discharge of any extinguishing agent.
(e) Set the detection and alarm system in the appropriate test mode and isolate ancillary facilities to avoid inadvertent operation.
(f) “Lock-Out” the equipment to prevent its operation and movement whilst performing any maintenance activities in and around the equipment.

On completion of any service, the system shall be restored to its normal operating condition.

Pre-Maintenance Review (Design Survey)

The design survey together with the inspection, test and preventive maintenance regime demonstrates that the fire protection systems or equipment are functional and capable of performing to a standard not less than that to which they were originally designed.

Prior to commencing any maintenance activities, a pre-maintenance review shall be undertaken to determine whether:

(a) the system will perform as it is intended to the design at the time of commissioning or recommissioning;
(b) the date and level of the last scheduled maintenance that has been carried out. Where this cannot be determined, the level of service is to be based from the cylinder date of manufacture.
(c) neither the fire protection system nor the equipment being protected has changed from the documented system design (baseline data) as of the last commissioning. For example, obstructions to nozzles or fire protection system component changes.

The pre-maintenance review shall include a check against the baseline data, including the approved design for alterations, changes in use or operating environment, or other factors that could adversely affect the performance of the fire protection system.

Any changes to the design of the system including changing the number and or location of nozzles, the number and location of cylinders and or increasing or decreasing the length of discharge pipework shall require a system recommissioning in accordance with the PEFS F3 Design, Installation and Commissioning Manual.

Water Quality

In many areas around Australia, whilst the water may be of drinking quality (potable), it may still contain high levels of chloride salts that make the water unsatisfactory for prolonged contact under pressure in stainless steel cylinders. The presence of salts in water that is used to fill PEFS F3 cylinders may have an impact to the firefighting performance of the foam, can clog the pressure indicator, bind the valve actuation mechanism, inhibit the removal of the cylinder valve and or lead to pitting corrosion of the cylinder.

The maximum limit of chloride ions in water used to fill PEFS cylinders is 150ppm. Only dry nitrogen (not compressed air) shall be used to pressurise PEFS F3 systems.
Where the water quality is in doubt at a particular location where filling activities are carried out, the use of water from another location source should be used. Failure to do so may result in rapid deterioration of the cylinder assembly, leading to leakage or failure to operate. Routine service shall be undertaken more regularly where:

(a) water quality has proved to be a problem, or is likely to be a problem;
(b) salts are deposited in the cylinder; or
(c) hard water is used.

**System Defects**

Defects, including faulty or defective components advised by public notices or manufacturers’ service bulletins, shall be replaced, exchanged or repaired.

Critical defects shall be rectified with the minimum of delay. Unless alternative risk reduction measures are implemented for the safety of personnel, equipment shall not be operated until the critical defects are rectified. Critical defects shall be reported to the responsible entity and confirmed in writing within 24 h.

An ‘out-of-service’ tag system should be used to indicate that the system is temporarily impaired. Tags should be attached to the affected equipment for the duration of the impairment. Evidence of the service level shall not be applied to the service tag or label. The inspection and the outcome shall be entered in the service records.

Non-critical defects shall be rectified as soon as practicable and reported to the responsible entity.

**Service Records**

A service record at the completion of any scheduled maintenance should be provided to the equipment owner or responsible entity. The service record should contain the following information:

1. Service activities.
2. Defects.
3. Rectifications and by whom.
4. Date conducted.
5. Where modification to the system has occurred:
   a. Updated system baseline data or fire system specification
   b. System re-commissioning report.

A service tag or label should be provided for each fire protection system to record the last level of inspection, test and survey performed.

The level of service carried out shall be etched, embossed stamped, or indelibly marked on the tag or label in the box corresponding to the year and month in which the routine was performed, with a figure representing the routine as follows:

```
Punched hole  = commissioned/placed in-service
  1 = Six-monthly
  2 = Yearly
  3 = Five yearly
  4 = Recharged after use
```

The figures shall be not less than 3mm high, and the markings shall be such that the figures are legible.

When a new service label is provided, the label shall be applied adjacent to the completed label so that the previous service history is not obscured.
**Recommended Tool List**

The following tool list is provided as a guide only.

### PEFS F3 Tools

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressurising Rig</td>
<td>87033</td>
</tr>
<tr>
<td>Charging Adaptor</td>
<td>130632</td>
</tr>
<tr>
<td>Nozzle Cap Removal Tool - Tee Handle</td>
<td>95003</td>
</tr>
<tr>
<td>Nozzle Cap Removal Tool - Socket</td>
<td>95004</td>
</tr>
<tr>
<td>Over-Fill Tube C23</td>
<td>36205</td>
</tr>
<tr>
<td>Over-Fill Tube C30</td>
<td>36206</td>
</tr>
<tr>
<td>Over-Fill Tube C45</td>
<td>36207</td>
</tr>
<tr>
<td>Over-Fill Tube C65</td>
<td>36208</td>
</tr>
<tr>
<td>Over-Fill Tube C106</td>
<td>36209</td>
</tr>
<tr>
<td>Over-Fill Tube O-ring</td>
<td>90127</td>
</tr>
</tbody>
</table>

### Recommended Common Tools

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape measure (5m minimum)</td>
</tr>
<tr>
<td>Portable tube bender (to suit 12.7mm OD tube)</td>
</tr>
<tr>
<td>Flaring tool - 37° (to suit 12.7mm OD tube)</td>
</tr>
<tr>
<td>Hand / Drill type deburring tool 2-14mm</td>
</tr>
<tr>
<td>Angle grinder 100 mm</td>
</tr>
<tr>
<td>Drill (Heavy duty) - 12.7 mm chuck</td>
</tr>
<tr>
<td>Drill Set 1mm - 13mm x 0.5mm (high speed)</td>
</tr>
<tr>
<td>Socket set - metric 4mm - 19mm, A/F 3/16” - 15/16”</td>
</tr>
<tr>
<td>Spanner Set - metric 7mm - 22mm, A/F 1/4” - 1”</td>
</tr>
<tr>
<td>Adjustable Spanners 250mm &amp; 450mm</td>
</tr>
<tr>
<td>Files - Round and Flat (medium bastard) 250mm</td>
</tr>
<tr>
<td>Hex Wrench set (Allen keys) Metric &amp; Imperial</td>
</tr>
<tr>
<td>Portable drop saw</td>
</tr>
<tr>
<td>Hacksaw</td>
</tr>
<tr>
<td>Safety knife</td>
</tr>
<tr>
<td>Screwdriver set 13 Piece</td>
</tr>
<tr>
<td>Hammer - Ball Pein</td>
</tr>
<tr>
<td>Side cutters 250mm</td>
</tr>
<tr>
<td>Funnel and measuring jug</td>
</tr>
<tr>
<td>Digital scales</td>
</tr>
<tr>
<td>Pliers (combination) 225mm</td>
</tr>
<tr>
<td>Multigrips 250mm</td>
</tr>
<tr>
<td>Cable cutters</td>
</tr>
<tr>
<td>Lock-Out devices</td>
</tr>
<tr>
<td>Loctite 577 pipe thread sealant or Loctite 569 hydraulic thread sealant</td>
</tr>
<tr>
<td>Molykote 111 lubricant or equivalent silicon based o-ring lubricant.</td>
</tr>
<tr>
<td>Loctite C5-A Anti-Seize Lubricant</td>
</tr>
</tbody>
</table>

Table 1 – Recommended Tool List
Service Schedule

The following maintenance schedule is based on the schedule detailed in AS5062 and those requirements applicable to all the hardware and design features detailed in the PEFS F3 Design, Installation and Commissioning manual. The maintenance schedule is ordered in the recommended sequence of maintenance activities for the PEFS LOP System and does not follow the order given in AS5062.

Commencement of the routine service schedule should begin at the completion date of the initial system commissioning. When carrying out the service on an existing installed system where the service history is unknown the Yearly Service Schedule should be performed.

For more detailed maintenance instructions on electrical control systems, panels, detectors and auxiliary electrical devices please refer to their respective product manuals.

Daily Routine Service Schedule

The following daily inspection items should be completed by the operator prior to equipment start-up, shift change or operator change.

<table>
<thead>
<tr>
<th>Item</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>System pressure check.</td>
<td>Check all cylinder valves and LOP manual actuator pressure indicators are visible and read within normal range.</td>
</tr>
</tbody>
</table>
| Manual actuators | (a) Check that all anti tamper seals and pull pins are in place and secure.  
                 | (b) Physically check that all manual actuators are secure, clean, undamaged and accessible. |
| System control and indicating equipment where fitted | (a) Check that all indicators show normal condition.  
                                                    | (b) Check that all panels are secure, clean, undamaged and accessible. |

Table 2 – Daily Service Schedule

Six-monthly and Yearly Routine Service Schedule

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Action</th>
<th>6 Mthly</th>
<th>Yrly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System pressure check.</td>
<td>Check all cylinder valves and LOP manual actuator pressure indicators are visible and read within normal range.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
| 2        | System control and indicating equipment where fitted | (a) Check that all indicators show normal condition.  
                                                    | (b) Check that all panels are secure, clean, undamaged and accessible.  
                                                    | (c) Test all indicators and audible alarms.  
                                                    | (d) Test battery capacity (if fitted) | ✓ | ✓ |
| 3        | Distribution system | (a) Clean Nozzles and Shrouds. Check nozzle caps are in place and falls are intact.  
                               | (b) Check nozzles are pointing at pre-determined aiming points.  
                               | (c) Check distribution system, (hoses, tube, fittings and supports) are intact and not damaged. | ✓ | ✓ |
| 4        | Actuation system | (a) Pneumatic actuation system - Check hoses, manifold blocks, fittings and supports are intact and not damaged.  
<pre><code>                           | (b) Electric actuation system (if fitted) - Check wiring, connections and supports are intact and not damaged. | ✓ | ✓ |
</code></pre>
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Action</th>
<th>6 Mthly</th>
<th>Yrly</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Manual actuators</td>
<td>(a) Check that all anti tamper seals and pull pins are in place and secure.</td>
<td>✔️</td>
<td>🍊</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Physically check that all manual actuators are secure, clean, undamaged and accessible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Test operation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Detection system</td>
<td>(a) Pneumatic detection system (LOP Tubing) - Check detection hoses, LOP tubing, fittings and supports are intact and not damaged and are in position.</td>
<td>🍊</td>
<td>✔️</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Electric detection system (if fitted) - Check detectors, wiring, connection and supports are in intact, not damaged and detectors are in position.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Storage containers</td>
<td>(a) Check cylinders and valves are not damaged.</td>
<td>✔️</td>
<td>🍊</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Check cylinders and mounting brackets are secure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>System Labels</td>
<td>Check Cylinder, LOP Manual Actuator and system warning and instruction labels are securely in place, visible and legible.</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Discharge test (optional)</td>
<td>(a) Conduct discharge test and record result</td>
<td>🍊</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Check fire suppression system nozzle area coverage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Storage containers</td>
<td>(a) Remove cylinder and inspect mounting bracket and cylinder for damage and condition.</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Check date of test or manufacture on storage container. If over 5 years old – subject the cylinder to an inspection and hydrostatic pressure test in accordance with AS 2030.5 and AS2337.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Container valves</td>
<td>Service and lubricate the LOP Valve</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Extinguishing agent solution</td>
<td>Replace foam solution in cylinders</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Distribution system</td>
<td>Conduct clear passage test using dry nitrogen and physically check distribution system, (i.e. that hoses, tube, fittings and supports are secure).</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mechanical actuator</td>
<td>Service and lubricate the LOP Manual Actuators</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Detection system - Pneumatic</td>
<td>Pneumatic detection system (LOP Tubing):</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i) replace the LOP Detection Tubing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) test pneumatic circuits for leaks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) check hoses, LOP tubing, fittings and supports are secure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Actuation system – Pneumatic</td>
<td>(a) test pneumatic circuits for leaks</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) check hoses, manifold blocks, fittings and supports are secure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Actuation system – Electrical (where fitted)</td>
<td>(a) Function test all actuation circuits. Ensure LOP Electric Actuator opens and closes correctly.</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) check all wiring for earths</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) check wiring, connections and supports are secure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Detection system - Electrical (where fitted)</td>
<td>Electric detection system (if fitted)</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i) function test all detectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) check all wiring for earths</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) check wiring, connections and supports are secure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Item</td>
<td>Action</td>
<td>6 Mthly</td>
<td>Yrly</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
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<td>------</td>
</tr>
<tr>
<td>19</td>
<td>System interface and shutdown (where fitted)</td>
<td>Test all fire suppression system activated equipment shutdowns and record delay time.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>20</td>
<td>Nozzle obstructions</td>
<td>Check for adequate clear space at nozzles and for obstructions likely to impede discharge.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>21</td>
<td>Nozzle location and coverage</td>
<td>Check for the introduction of fixtures and bulkheads shielding nozzle discharge and the presence of unprotected hazard areas, particularly where a source of fuel and heat exists.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>22</td>
<td>Detector coverage</td>
<td>Check for the presence of unprotected hazard areas, particularly where a source of fuel and heat exists.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>23</td>
<td>Operational conditions</td>
<td>Check that the detector response and extinguishing agent discharge or retention will not be adversely affected by such things as enclosure openings, ventilation airflows or high temperature protected areas.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>24</td>
<td>Environmental conditions</td>
<td>Check that the fire system and its components are suitable for the environmental conditions in which the machine is operating, e.g. that components are suitable for underground mining, and road gradient and slopes are within container orientation limits.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>25</td>
<td>Survey</td>
<td>Complete review of system to confirm it is in accordance with the approved design and no changes have been made which would impair performance.</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 3 – Six-monthly and Yearly Service Schedule
Six Monthly Service Instructions

System pressure check (Item 1)

1. Check the reading on the pressure indicator located on the cylinder valve of each cylinder assembly installed. The pressure should read within the green segment of the indicator.
2. Check the reading on the pressure indicator located on each LOP manual actuator installed. The pressure should read within the green segment of the indicator.
3. If system is low on pressure, the source of the leak should be identified and rectified prior to re-pressurising the system.
4. If the system pressure shows 0kPa, it is likely the system has been discharged and will need to be refilled.
5. If a pressure indicator reads differently to all of the other pressure indicators, this pressure indicator is most likely faulty or out of calibration. Replace the faulty pressure indicator. Refer to section on valve service and actuator service located later in this manual.

System control and indicating equipment [where fitted] (Item 2)

Note: Refer to Control System / Panel product manuals for detailed operational and maintenance requirements.

1. Check that all indicators show normal condition:
   a. Power on indicator light illuminated
   b. Fault indicators are not illuminated
   c. System Discharge indicators are not illuminated
   d. Fire Alarm indicators are not illuminated
   e. System Isolation indicators are not illuminated
   f. Audible alarms not sounding
2. Set control panel (where applicable) to its “Isolation / Test” mode.

⚠️ WARNING: System Control Panels must remain in their “Isolation / Test” mode during the remainder of the scheduled maintenance activities to prevent accidental discharge of the system.

3. Check that all status indicators and audible alarms function correctly.
4. Check that all panels are secure, clean, undamaged and accessible.
5. Test battery capacity (if fitted).

Distribution system (Item 3)

1. Clean Nozzles and Shrouds.
2. Check nozzle caps are in place and foils are intact. Replace foil caps if required.
   a. Foil Caps should only be fitted and removed using the Nozzle Cap Tool
   b. Always screw on the Foil Caps by hand for the first couple of turns before using the Nozzle Cap Tool to tighten the cap to prevent cross threading.
3. Check nozzles are pointing at pre-determined aiming points. Refer to system design data (baseline data) as of last commissioning.
4. Check distribution system is intact and not damaged:
   a. Hoses are not worn, split, cut or kinked.
   b. Hoses have protective sleeves fitted along locations where rubbing can occur.
   c. Tubing is not dented, kinked or otherwise damaged
   d. Fittings do not show signs of excessive corrosion
   e. Fittings are secure
   f. Clamps are adequately secured to the equipment and firmly hold the discharge hoses and or tubing in place.
   g. Nozzle brackets (where fitted) are adequately secured to the equipment and firmly holds the nozzle kit fittings.

Actuation system (Item 4)

1. Check pneumatic actuation system is intact and not damaged:
   a. Hoses are not worn, split, cut or kinked.
   b. Hoses have protective sleeves fitted along locations where rubbing can occur.
   c. Fittings do not show signs of excessive corrosion
   d. Fittings are secure
e. Manifold block is adequately secured to the equipment.
f. Clamps are adequately secured to the equipment and firmly hold the actuation hose in place.

2. Check electric actuation system (if fitted) is intact and not damaged:
a. Electrical cabling is not worn, split, cut or kinked.
b. Electrical cabling has protective sleeves fitted along locations where rubbing can occur.
c. Electrical connectors are intact and not damaged.
d. Separate connectors and check to ensure they are free from ingress of dirt, water and corrosion. Replace if required. Re-connect all electrical connectors.
e. All cabling clamps and supports are adequately secured to the equipment and firmly holds the cabling in place.

Manual Actuators (Item 5)

⚠️ WARNING: The cylinder and actuation pipework contains high pressure. Do not remove any parts from the cylinder or actuation pipework unless it is depressurised first.

Note: The LOP Manual actuators are designed to “fail to safe”. That is any fault causing leakage will activate the system. As such the LOP Manual actuators may be considered operational if the below listed checks are carried out.

1. Check that all actuators are intact and not damaged.
2. Check that all actuators are accessible and access has not been restricted by equipment modification.
3. Check that all pull pins and security ties (anti tamper seals) are in place and secure. Replace security ties if missing or broken.
4. Check that the pull pin retainer wire is correctly securing the pull pin to the actuator.
5. Check to ensure pressure is reading in the green sector of the pressure indicator.
6. Remove the front housing cover and check that all actuators are:
   a. Clean and undamaged.
   b. Foil is intact on outlet port nozzle. Replace if required.
   c. Schrader Valve has cap fitted to protect against ingress of dust and dirt.
7. Check that all actuators are adequately secured to the equipment.
8. Leak Test all connection points (refer figure below) with a liquid leak detection solution. If actuator shows any signs of leakage, carry out service on actuator.

9. Re-fit housing cover and ensure it is securely bolted on and label is intact and readable.

Figure 1
Detection System (Item 6)

**WARNING:** The cylinder and actuation pipework contains high pressure. Do not remove any parts from the cylinder or actuation pipework unless it is depressurised first.

1. Check LOP Tubing is intact and not damaged:
   a. LOP Tubing is not worn, split, cut or kinked.
   b. LOP Tubing is located in correct position. Refer to system design data (baseline data) as of last commissioning.
   c. Check to ensure any modifications to equipment has not subjected LOP Tubing to possible heat exposure greater than 90°C.
   d. Fittings do not show signs of excessive corrosion.
   e. Fittings are secure.
   f. Clamps are adequately secured to the equipment and firmly hold the LOP Tubing in place.

2. Check electric detection system (if fitted) is intact and not damaged:
   a. Electrical cabling is not worn, split, cut or kinked.
   b. Electrical cabling has protective sleeves fitted along locations where rubbing can occur.
   c. Electrical connectors are intact and not damaged.
   d. Separate connectors and check to ensure they are free from ingress of dirt, water and corrosion. Replace if required. Re-connect all electrical connectors.
   e. All cabling clamps and supports are adequately secured to the equipment and firmly holds the cabling in place.
   f. Detector locations are in correct position. Refer to system design data (baseline data) as of last commissioning.

Storage containers (Item 7)

1. Check all cylinder valves are not damaged.
2. Check all cylinder burst disk assemblies are not damaged. Use of a vinyl protective cap over the burst disk assembly is recommended to prevent ingress of dirt and wear on the burst disk surface.
3. Visually inspect exterior of all installed cylinders. Where a cylinder is dented, scored, pitted or otherwise damaged by corrosion and it cannot be determined if the damage is within the limits as detailed in AS 2337.1, then the cylinder shall be condemned.
4. Check the manufacture date and or last pressure test date of all installed cylinders. If this exceeds five years old then the cylinder will require an inspection and hydrostatic test in accordance with AS2030.5 and AS2337.1.
5. Check cylinders and mounting brackets are secure.

System Labels (Item 8)

Check Cylinder, LOP Manual Actuator and system warning and instruction labels are securely in place, visible and legible.

After Maintenance Activities

After all 6 monthly maintenance activities have been completed:

1. Ensure all pressure indicators are reading in the green zone.
2. Ensure control panel (where fitted) is reset to its normal operation mode and is no longer in its “Isolation / Test” mode.
3. Complete routine service records in accordance with AS5062
4. Stamp Service Tag with the number “1” in the corresponding Year/Month location.
Yearly Service Instructions

Discharge Test [Optional] (Item 9)

An annual discharge test can be used to confirm the complete PEFS F3 system operates and performs as that intended as when originally commissioned.

Please refer to the Chubb PEFS F3 Vehicle Fire Suppression System SDS prior to carrying out the Discharge Test. Discharge of foam solution must be handled according to national or local waste regulations. Permission must be granted from the site representative before carrying out the discharge test.

1. Check system pressure is reading in the green sector on the pressure indicators located on the cylinder valves and manual actuators.
2. Discharge the PEFS system using the furthest located LOP manual actuator
3. Confirm all nozzles discharge and produce conical spray pattern.
4. Check that the nozzle discharge patterns cover the fire hazard area as specified in the commissioning documentation.
5. Check that all monitoring and control panel alarms, shutdown and ancillary functions operate as intended
6. Record the Effective Discharge Time (EDT) and compare it to the EDT recorded during commissioning.

Storage containers (Item 10)

1. Remove discharge hose (3) from cylinder valve (4).
2. Fit end cap to discharge outlet port to prevent accidental discharge.
3. Remove Schrader valve cap from filler port assembly (1).
4. Depress Schrader valve core to release cylinder pressure.
5. Check that the pressure indicator on LOP Cylinder Valve (4) shows 0kPa.
6. Reinstall Schrader valve cap.
7. Remove actuation hose (2) from top of cylinder valve (4).
8. Remove filler port assembly (1)
9. Remove foam solution from the cylinder.
10. Check all cylinder burst disk assemblies are not damaged. Use of a vinyl protective cap over the burst disk assembly is recommended to prevent ingress of dirt and wear on the burst disk surface.
11. Visually inspect exterior of all installed cylinders. Where a cylinder is dented, scored, pitted or otherwise damaged by corrosion and it cannot be determined if the damage is within the limits as detailed in AS 2337.1, then the cylinder shall be condemned.
12. Visually inspect interior of all installed cylinders. Where a cylinder is damaged by corrosion and it cannot be determined if the damage is within the limits as detailed in AS 2337.1, then the cylinder shall be condemned.
13. Check the manufacture date and or last pressure test date of all installed cylinders. If this exceeds five years old then the cylinder will require an inspection and hydrostatic test in accordance with AS2030.5 and AS2337.1.
14. Check brackets are not damaged and secure.
15. Re-fit and secure cylinders into brackets.
**Cylinder Valve – Service (Item 11)**

⚠️ **WARNING:** The cylinder is a pressure vessel. Do not remove any parts from the cylinder prior to depressurising the cylinder.

![Figure 3](image)

A Valve Service Kit (Part No: 28037) is available for the purpose of servicing the LOP valve.

1. Remove cylinder valve (4) from cylinder.
2. Remove Syphon Tube (5) and Cylinder Neck O-ring (6)
3. Remove the 4 screws and washers (7).
4. Remove the cap (8) and o-ring (9).
5. Remove the piston assembly (10).
6. Inspect and clean piston o-rings (11) and sealing o-ring (15). Replace if they shows signs of wear or damage. Check to ensure check valve (16) moves freely inside piston, clean and or replace if required. Lubricate outside diameter o-rings (11) and outside diameter of piston assembly (10) with Molykote 111. Do not lubricate sealing o-ring (15) and check valve o-ring (16). If retainer (12) was removed, re-fit using Loctite 569 or Loctite 577 on thread.
8. Inspect and clean o-ring (9) and replace if it shows signs of wear or damage. Lubricate o-ring (9) with Molykote 111 and fit to cap (8).
9. Re-install cap (8), washers and screws (7) to cylinder valve.
10. Inspect syphon tube (5). Replace if tube has become stiff or is damaged.
11. Inspect and clean Cylinder Neck O-ring (6) and replace if it shows signs of wear or damage. Lubricate with Molykote 111.
12. Inspect and clean Pressure Indicator (13) and Schrader Valve (14). Replace if faulty or damaged. Use Loctite 577 or Loctite 569 on threads.
13. Re-install cylinder valve (4) to cylinder.
Cylinder Refilling (Item 12)

⚠️ WARNING: The cylinder is a pressure vessel. Do not remove any parts from the cylinder prior to depressurising the cylinder.

Cylinders must only be filled with clean potable water (chloride ion content <150ppm). The fill quantities for each size cylinder are detailed in the table below.

Please refer to the Chubb PEFS F3 Foam Concentrate SDS prior to handling the foam concentrate.

<table>
<thead>
<tr>
<th>Cylinder Size</th>
<th>Total Fill</th>
<th>Water quantity</th>
<th>Foam quantity</th>
<th>Fill Kit Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C23 cylinder assembly</td>
<td>18 lt.</td>
<td>16 lt.</td>
<td>2 lt.</td>
<td>51010</td>
</tr>
<tr>
<td>C30 cylinder assembly</td>
<td>24 lt.</td>
<td>21.5 lt.</td>
<td>2.5 lt.</td>
<td>51011</td>
</tr>
<tr>
<td>C45 cylinder assembly</td>
<td>35 lt.</td>
<td>31 lt.</td>
<td>4 lt.</td>
<td>51012</td>
</tr>
<tr>
<td>C65 cylinder assembly</td>
<td>50 lt.</td>
<td>44 lt.</td>
<td>6 lt.</td>
<td>51013</td>
</tr>
<tr>
<td>C106 cylinder assembly</td>
<td>85 lt.</td>
<td>75 lt.</td>
<td>10 lt.</td>
<td>51014</td>
</tr>
</tbody>
</table>

Table 4 Cylinder Filling Volumes

Method 1: Pre-Mixing (scales recommended)

**C23 Cylinder**

1. Remove Filler Plug Assembly.
2. Fill system cylinder with 10 litres of water
3. In a 10 litre bucket:
   a. Fill with 6 litres of water
   b. Add the full quantity of foam from the C23 Fill Kit bottle.
   c. Stir slowly until mixed
   d. Do not over agitate the foam to prevent it from foaming up.
   e. Foam should mix in about two to three minutes
4. Pour the pre-mixed foam solution from the bucket into the system cylinder
5. Refit Filler Plug Assembly.

**C30 Cylinder**

1. Remove Filler Plug Assembly.
2. Fill system cylinder with 9.5 litres of water
3. In a 10 litre bucket:
   a. Fill with 6 litres of water
   b. Add half (1/2) of the quantity of foam from the C30 Fill Kit bottle.
   c. Stir slowly until mixed
   d. Do not over agitate the foam to prevent it from foaming up
   e. Foam should mix in about two to three minutes
4. Pour the pre-mixed foam solution from the bucket into the system cylinder
5. Repeat steps 2 – 3 above.
6. Refit Filler Plug Assembly.

**C45 Cylinder**

1. Remove Filler Plug Assembly.
2. Fill system cylinder with 19 litres of water
3. In a 10 litre bucket:
   a. Fill with 6 litres of water
   b. Add half (1/2) of the quantity of foam from the C45 Fill Kit bottle.
   c. Stir slowly until mixed
   d. Do not over agitate the foam to prevent it from foaming up
   e. Foam should mix in about two to three minutes
4. Pour the pre-mixed foam solution from the bucket into the system cylinder
5. Repeat steps 2 – 3 above.
6. Refit Filler Plug Assembly.

**C65 Cylinder**

1. Remove Filler Plug Assembly.
2. Fill system cylinder with 26 litres of water
3. In a 10 litre bucket:
   a. Fill with 6 litres of water
   b. Add one third (1/3) of the quantity of foam from the C65 Fill Kit bottle.
   c. Stir slowly until mixed
   d. Do not over agitate the foam to prevent it from foaming up
   e. Foam should mix in about two to three minutes
4. Pour the pre-mixed foam solution from the bucket into the system cylinder
5. Repeat steps 2 – 3 above until all the foam concentrate has been pre-mixed and added to the system cylinder.
6. Refit Filler Plug Assembly.
C106 Cylinder

1. Remove Filler Plug Assembly.
2. Fill system cylinder with 51 litres of water
3. In a 10 litre bucket:
   a. Fill with 6 litres of water
   b. Add one quarter (1/4) of the quantity of foam from the C106 Fill Kit bottle.
   c. Stir slowly until mixed
   d. Do not over agitate the foam to prevent it from foaming up
   e. Foam should mix in about two to three minutes
4. Pour the pre-mixed foam solution from the bucket into the system cylinder
5. Repeat steps 2 – 3 above until all the foam concentrate has been pre-mixed and added to the system cylinder.
6. Refit Filler Plug Assembly.

Method 2: Post-Mixing (requires mixing tool)

1. Remove Filler Plug Assembly.
2. Filling by Scales:
   a. Remove Over-fill tube (if fitted) from filling port.
   b. Fill cylinder with water to required volume as per Table 4 Cylinder Filling Volumes
   c. Add complete contents of foam from the Filling Kit.
3. Filling by Over-fill tube (LOP valve must be fitted to cylinder in closed position):
   a. Ensure Over-fill tube is correctly seated in filling port.
   b. Add water to cylinder until it initially over-flows. (Do not insert water supply hose below the bottom of the Over-fill tube.)
   c. Remove Over-fill tube from filling port.
   d. Add complete contents of foam from the Filling Kit.
4. Insert mixing tool and mix for at least 10 minutes.
   a. Ensure mixing tool reaches the bottom of the cylinder
   b. Ensure to keep the mixing tool near the sides of the cylinder away from the syphon tube.
5. Refit Filler Plug Assembly.
Distribution System – Clear Passage Test (Item 13)

1. Disconnect discharge hose from cylinder valve.
2. Remove Nozzle Foil Caps from nozzles.
3. Flush discharge network with water and/or compressed air/nitrogen
4. Check distribution network is clear of any blockages
5. Clean Nozzles and Shrouds.
6. Re-fit Nozzle Foil Caps. Replace foil caps if required.
   a. Foil Caps should only be fitted and removed using the Nozzle Cap Tool
   b. Always screw on the Foil Caps by hand for the first couple of turns before using the Nozzle Cap Tool to tighten the cap to prevent cross threading.
7. Check nozzles are pointing at pre-determined aiming points. Refer to system design data (baseline data) as of last commissioning.
8. Check distribution system is intact and not damaged:
   a. Hoses are not worn, split, cut or kinked.
   b. Hoses have protective sleeves fitted along locations where rubbing can occur.
   c. Tubing is not dented, kinked or otherwise damaged
   d. Fittings do not show signs of excessive corrosion
   e. Fittings are secure.
   f. Clamps are adequately secured to the equipment and firmly hold the discharge hoses and or tubing in place.
   g. Nozzle brackets (where fitted) are adequately secured to the equipment and firmly holds the nozzle kit fittings.
**Manual Actuators – Service (Item 14)**

**WARNING:** Do not loosen any hose connections or fittings in the LOP actuation system while the system is pressurised. This will cause the system to discharge. Prior to servicing any LOP actuators ensure the system is depressurised by depressurising the PEFS F3 cylinders using the Schrader valve fitted to the cylinder Filler Plug Assembly. Ensure pressure indicators on manual actuator reads zero pressure.

![Figure 4](image)

A LOP Actuator Service Kit (Part No: 28038) is available for the purpose of servicing the LOP manual actuator.

1. Remove the actuator cover plate.
2. Remove actuation hose from actuator connection (1).
3. Remove Foil Nozzle (2) and Adaptor (3).
4. Check the Foil Nozzle (2) to ensure its foil seal is intact and not damaged or ruptured. Replace if required.
5. Remove Pull Pin (4).
6. Remove Push Button (5) and Nut (6).
7. Remove valve piston assembly (7) from valve body.
8. Inspect and clean piston o-rings (8) and replace if they show signs of wear or damage. Lubricate using Molykote 111.
9. Refit valve piston assembly (7) to valve body.
10. Ensure that the actuation mechanism moves freely.
11. Refit Nut (6) and Push Button (5). Tighten nut up against Push Button.
12. Refit Pull Pin (4).
13. Refit Adaptor (3) and Foil Nozzle (2). Use Loctite 577 or Loctite 569 on threads.
14. Inspect and clean Pressure Indicator (9) and or Schrader Valve (10). Replace if faulty or damaged. Use Loctite 577 or Loctite 569 on threads.
15. Reconnect actuation hose to actuator connection (1).
**Detection system – Pneumatic (Item 15)**

**WARNING:** Do not loosen any hose connections or fittings in the LOP actuation system while the system is pressurised. This will cause the system to discharge. Prior to replacing any LOP detection tubing ensure the system is depressurised by depressurising the PEFS F3 cylinders using the Schrader valve fitted to the cylinder Filler Plug Assembly.

After having depressurised the PEFS F3 system:

1. Replace each length of LOP detection tubing.
2. Ensure LOP tubing does not kink.
3. Check LOP Tubing is located in correct position. Refer to system design data (baseline data) as of last commissioning.
4. Check to ensure any modifications to equipment has not subjected LOP Tubing to possible heat exposure greater than 90°C.
5. Check LOP tubing fittings do not show signs of excessive corrosion.
6. Check LOP tubing fittings are secure.
7. Check LOP tubing clamps are adequately secured to the equipment and firmly hold the LOP tubing in place.

**Actuation system – Pneumatic (Item 16)**

Check pneumatic actuation system is intact and not damaged:

1. Hoses are not worn, split, cut or kinked.
2. Hoses have protective sleeves fitted along locations where rubbing can occur.
3. Fittings do not show signs of excessive corrosion.
4. Fittings are secure.
5. Manifold block is adequately secured to the equipment.
6. Clamps are adequately secured to the equipment and firmly hold the actuation hose in place.

**Actuation system – Electrical [where fitted] (Item 17)**

**Note:** The following maintenance activities should be carried out in conjunction with the listed fire control system manuals.

1. Check electric actuation system is intact and not damaged:
   a. Electrical cabling is not worn, split, cut or kinked.
   b. Electrical cabling has protective sleeves fitted along locations where rubbing can occur.
   c. Electrical connectors are intact and not damaged.
   d. Separate connectors and check to ensure they are free from ingress of dirt, water and corrosion. Replace if required. Re-connect all electrical connectors.
   e. All cabling clamps and supports are adequately secured to the equipment and firmly holds the cabling in place.
2. Function test all actuation circuits. Ensure each LOP Electric Actuator opens and closes correctly.
3. Check all wiring for earths.
**Detection system - Electrical [where fitted] (Item 18)**

**Note:** The following maintenance activities should be carried out in conjunction with the listed fire control system manuals.

1. Check electric detection system is intact and not damaged:
   a. Electrical cabling is not worn, split, cut or kinked.
   b. Electrical cabling has protective sleeves fitted along locations where rubbing can occur.
   c. Electrical connectors are intact and not damaged.
   d. Separate connectors and check to ensure they are free from ingress of dirt, water and corrosion. Replace if required. Re-connect all electrical connectors.
   e. All cabling clamps and supports are adequately secured to the equipment and firmly holds the cabling in place.
   f. Detector locations are in correct position. Refer to system design data (baseline data) as of last commissioning.
2. Function test all detectors
3. Check all wiring for earths

**System interface and shutdown [where fitted] (Item 19)**

**Note:** The following maintenance activities should be carried out in conjunction with the listed fire control system manuals.

Test all fire suppression system activated equipment shutdowns and record delay time.

**System Pressurising**

LOP systems are pressurised using the Schrader valve fitted on top of the LOP Valve Assembly or using the Schrader valve fitted on the manual LOP actuators.

**WARNING:** Do not pressurise a cylinder that is not in test date.

**NOTE:** Do not pressurise LOP systems using the schrader valve on the filler port assembly of the PEFS cylinders. This will cause the cylinder to discharge.

1. Cap the discharge port of each cylinder valve to prevent solution loss in the event of an accidental discharge.
2. Check to ensure that all electrical actuation devices have been isolated.
3. Connect a regulated source of nitrogen through an approved charging rig (refer Figure 5) to either:
   a. the cylinder valve assembly charging point
   b. the charging point on one of the LOP manual actuators
4. Pressurise the system to the correct listed pressure as per Table 5.
5. Hold pressure for a minimum of 1 minute. Increase this time for each additional cylinder.
6. Check the pressure indicator on the cylinder valve and ensure it reads in the green sector
7. Shut off supply at the control valve and unscrew the charging adaptor (internal)
8. Vent pressure from the charging rig prior to disconnecting adaptor then disconnect the pressure source.
9. Test the actuation system for leaks. Leak testing should be carried out using a liquid leak detection solution.
   a. Leak test all fitting connections
   b. Leak test all LOP Manual actuators (refer above under 6 Monthly Service Instructions)
   c. Leak test all LOP Electrical actuators
10. Test the cylinder for leaks. Leak testing should be carried out using a liquid leak detection solution.
   a. Leak test filler port
   b. Leak test burst disk
   c. Leak test all ports on the LOP Valve assembly
   d. Leak test cylinder welds.
11. Remove caps from discharge ports and re-fit distribution hoses.
**Figure 5 – Typical Pressurising Rig**

<table>
<thead>
<tr>
<th>Ambient Temperature (°C)</th>
<th>Charge Pressure (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1602</td>
</tr>
<tr>
<td>10</td>
<td>1633</td>
</tr>
<tr>
<td>15</td>
<td>1663</td>
</tr>
<tr>
<td>21</td>
<td>1700</td>
</tr>
<tr>
<td>25</td>
<td>1725</td>
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<tr>
<td>30</td>
<td>1755</td>
</tr>
<tr>
<td>35</td>
<td>1786</td>
</tr>
<tr>
<td>40</td>
<td>1816</td>
</tr>
<tr>
<td>45</td>
<td>1847</td>
</tr>
<tr>
<td>50</td>
<td>1878</td>
</tr>
</tbody>
</table>

**Table 5 - PEFS F3 cylinder charging pressure versus ambient temperature**

**After Maintenance Activities**

After all Yearly maintenance activities have been completed:
1. Ensure all pressure indicators are reading in the green zone.
2. Ensure all labels are in good condition (refer 6 monthly service item 8)
3. Ensure control panel (where fitted) is reset to its normal operation mode and is no longer in its “Isolation / Test” mode.
4. Ensure panel status lights are in normal condition (refer 6 monthly service item 2)
5. Complete routine service records in accordance with AS5062
6. Stamp Service Tag with the number “2” in the corresponding Year/Month location.
# MAINTENANCE REPORT

Inspection and Maintenance Report for PEFS F3 Vehicle Fire Suppression System

<table>
<thead>
<tr>
<th>Work Order Number:</th>
<th>Date:</th>
</tr>
</thead>
</table>

## Client Information

- **Customer Name:**
- **Contact Name:**
- **Customer Address:**
- **Telephone:**
- **Mobile:**
- **Fax:**

## Equipment Information

- **Equipment Type:**
- **Equipment Make:**
- **Equipment Model:**
- **Equipment Serial No.:**
- **Equipment Location:**

## System Information

- **Cylinder Size:**
- **Qty:**
- **Serial Numbers:**
- **Manufacture Date:**
- **Qty Nozzles:**
- **Qty Manual Actuators:**
- **Fire Alarm Panel:** Standard [ ] Shutdown [ ] None [ ]

## Service

<table>
<thead>
<tr>
<th>Item</th>
<th>Service</th>
<th>6 Mthly</th>
<th>Yrly</th>
<th>Defect Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System Pressure – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>System control and indicating equipment – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Distribution system – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Actuation system – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Manual LOP Actuators – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Detection system – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Storage containers – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>System Labels – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Discharge Test [optional]</td>
<td></td>
<td></td>
<td>Discharge Time:</td>
</tr>
<tr>
<td>10</td>
<td>Storage containers - Inspect</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>11</td>
<td>Container valves - Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Extinguishing agent solution - Replace</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Distribution system - Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mechanical actuator - Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Detection system (Pneumatic) – Check &amp; Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Actuation system (Pneumatic) – Check &amp; Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Actuation system (Electrical) [where fitted] – Check &amp; Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Detection system (Electrical) [where fitted] – Check &amp; Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>System interface and shutdown [where fitted] – Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Nozzle obstructions – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Nozzle location and coverage – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Detector coverage – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Operational conditions – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Environmental conditions – Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Survey - Review</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record of all repairs: 

Record of parts used: 

Does system meet original Design Specifications: YES [ ] NO [ ]

If No, Changes: 

Name of Technician: ____________________ Signature: ____________________

Name of Customer: ____________________ Signature: ____________________
SPARE PARTS

Cylinder Assemblies & Brackets

Cylinders Assemblies

Figure 6

Cylinder Assembly Details:

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>112255</td>
<td>Burst Disk</td>
</tr>
<tr>
<td>2</td>
<td>23100</td>
<td>Filler Plug Assembly</td>
</tr>
<tr>
<td>3</td>
<td>90127</td>
<td>Filler Port O-Ring</td>
</tr>
<tr>
<td>4</td>
<td>60328</td>
<td>Label – Blue Identification Band C30 &amp; C45 Cylinders</td>
</tr>
<tr>
<td></td>
<td>60329</td>
<td>Label – Blue Identification Band C23 &amp; C65 Cylinders</td>
</tr>
<tr>
<td></td>
<td>60330</td>
<td>Label – Blue Identification Band C106 Cylinder</td>
</tr>
<tr>
<td>5</td>
<td>66139</td>
<td>Label – Main PEFS F3 Cylinder Label</td>
</tr>
</tbody>
</table>

Table 6 - PEFS F3 cylinder specifications

Table 7 – Cylinder Assembly Parts
**LOP Cylinder Valve**

![LOP Valve Assembly](image)

**Figure 7 – LOP Valve Assembly**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26023</td>
<td>PEFS F3 LOP Valve Assembly</td>
</tr>
<tr>
<td>28037</td>
<td>PEFS F3 LOP Valve Service Kit</td>
</tr>
</tbody>
</table>

**Table 8 – Valve Assembly**

**Siphon Tubes**

![Siphon tube](image)

**Figure 8 – Siphon tube**

<table>
<thead>
<tr>
<th>Cylinder Size</th>
<th>Siphon Tube Part Number</th>
<th>Syphon Tube Length (±2mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C23</td>
<td>109298</td>
<td>719</td>
</tr>
<tr>
<td>C30</td>
<td>110281</td>
<td>485</td>
</tr>
<tr>
<td>C45</td>
<td>110282</td>
<td>546</td>
</tr>
<tr>
<td>C65</td>
<td>110283</td>
<td>745</td>
</tr>
<tr>
<td>C106</td>
<td>112040</td>
<td>1156</td>
</tr>
</tbody>
</table>

**Table 9 – Siphon tube details**

**Fill Kits**

<table>
<thead>
<tr>
<th>Cylinder Size</th>
<th>Fill Kit Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>C23</td>
<td>51010</td>
</tr>
<tr>
<td>C30</td>
<td>51011</td>
</tr>
<tr>
<td>C45</td>
<td>51012</td>
</tr>
<tr>
<td>C65</td>
<td>51013</td>
</tr>
<tr>
<td>C106</td>
<td>51014</td>
</tr>
</tbody>
</table>

**Table 10 – Fill Kits**

**Over-fill Tubes**

<table>
<thead>
<tr>
<th>Cylinder Size</th>
<th>Part Number</th>
<th>Length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C23</td>
<td>36205</td>
<td>202</td>
</tr>
<tr>
<td>C30</td>
<td>36206</td>
<td>118</td>
</tr>
<tr>
<td>C45</td>
<td>36207</td>
<td>158</td>
</tr>
<tr>
<td>C65</td>
<td>36208</td>
<td>223</td>
</tr>
<tr>
<td>C106</td>
<td>36209</td>
<td>345</td>
</tr>
</tbody>
</table>

**Table 11 – Over-fill tube details**
**Cylinder Brackets**

**Figure 9 – C23 Cylinder Bracket**
(part number 128735)

**Figure 10 – C30 Cylinder Bracket**
(part number 128736)

**Figure 11 – C45 & C65 Cylinder Bracket**
(part number 128737)

**Figure 12 – C106 Cylinder Bracket**
(part number 128738)

**Figure 13 – Bracket Weld Lug Assembly**

- Bolt HT CL 8.8
  - 91323
- Spring Washer 94247
- Washer 94246
- Bracket Weld Lug
  - 128759
**Discharge Components**

**Stainless Steel Tube**

Part Number 112108 (2m lengths).

![Stainless Steel Tube and Fittings](image)

**Figure 14 – Stainless steel tube and fittings**

**Discharge Hose**

<table>
<thead>
<tr>
<th>Hose Size</th>
<th>Part Number</th>
<th>Minimum Bend Radius</th>
<th>Temperature Rating (Air/Water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot;</td>
<td>118097</td>
<td>180mm (7&quot;)</td>
<td>-40°C – 71°C</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>118098</td>
<td>240mm (9.5&quot;)</td>
<td></td>
</tr>
</tbody>
</table>

Table 12 – Discharge hose

**Nozzles**

![Nozzle Assembly](image)

**Figure 15 – Nozzle assembly**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>46125</td>
<td>BM11W Foil Nozzle c/w Cap and Shroud</td>
</tr>
<tr>
<td>46126</td>
<td>BM11W Foil Nozzle c/w Cap (less Shroud)</td>
</tr>
<tr>
<td>46127</td>
<td>Replacement Foil Cap</td>
</tr>
<tr>
<td>46503</td>
<td>Shroud</td>
</tr>
<tr>
<td>94255</td>
<td>Wave Washer</td>
</tr>
</tbody>
</table>

Table 13 Nozzle Parts
**Nozzle Kits**

- Nozzle kit single straight (part number 115371)
- Nozzle kit single straight 90° (part number 115152)
- Nozzle kit single end 90° (part number 115151)
- Nozzle kit single end (part number 94431)
- Nozzle kit double straight 90° (part number 115153)
- Nozzle kit double straight 90°/45° (part number 125316)
- Nozzle kit ¼” BSP for Bracket (part number 115815)
- Nozzle kit 3/8” BSP for Bracket (part number 130104)

Nozzle bracket part number: 104592 (Supplied separately)

*Figure 16 – Standard nozzle kits*
## Discharge Hose and Tube fittings

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hose Protector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40155</td>
<td>20mm Red - Suitable for ½” hose</td>
</tr>
<tr>
<td></td>
<td>40154</td>
<td>25mm Red - Suitable for ¾” hose</td>
</tr>
<tr>
<td><strong>Couplings (Field Attachable)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>118099</td>
<td>1/2” Hose x 3/4” JIC (f) swivel</td>
</tr>
<tr>
<td></td>
<td>118100</td>
<td>3/4” Hose x 1 1/16” JIC (f) swivel</td>
</tr>
<tr>
<td></td>
<td>128744</td>
<td>1/2” Hose x 3/4” JIC (m)</td>
</tr>
<tr>
<td><strong>Couplings (Crimp)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>116257</td>
<td>1/2” Hose x 3/4” JIC (f) swivel</td>
</tr>
<tr>
<td></td>
<td>128995</td>
<td>3/4” Hose x 1 1/16” JIC (f) swivel</td>
</tr>
<tr>
<td></td>
<td>129671</td>
<td>1/2” Hose x 3/4” JIC (m)</td>
</tr>
<tr>
<td><strong>Cap/Nut</strong></td>
<td>112145</td>
<td>3/4” JIC Nut &amp; Sleeve to suit 1/2” Tube</td>
</tr>
<tr>
<td><strong>Adaptor / Reducing Bushes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>112146</td>
<td>3/4” JIC (m) x 1 1/16” JIC (f)</td>
</tr>
<tr>
<td></td>
<td>112144</td>
<td>3/8” BSP (m) x 1/4” BSP (f)</td>
</tr>
<tr>
<td><strong>Nipples</strong></td>
<td>114545</td>
<td>3/4” JIC</td>
</tr>
<tr>
<td></td>
<td>128766</td>
<td>3/4” JIC Bulkhead</td>
</tr>
<tr>
<td></td>
<td>112142</td>
<td>1 1/16” JIC Bulkhead</td>
</tr>
<tr>
<td></td>
<td>112128</td>
<td>3/4” JIC x 3/4” BSP</td>
</tr>
<tr>
<td></td>
<td>112129</td>
<td>1 1/16” JIC x 3/4” BSP</td>
</tr>
<tr>
<td><strong>Socket</strong></td>
<td>112143</td>
<td>3/8” BSP (f) x 1/4” BSP (f)</td>
</tr>
<tr>
<td><strong>Plug/Cap</strong></td>
<td>128745</td>
<td>3/4” JIC (m)</td>
</tr>
<tr>
<td></td>
<td>128741</td>
<td>3/4” JIC (f)</td>
</tr>
<tr>
<td></td>
<td>137083</td>
<td>1 1/16” JIC cap</td>
</tr>
<tr>
<td><strong>Tees</strong></td>
<td>112130</td>
<td>3/4” JIC (m)</td>
</tr>
<tr>
<td></td>
<td>112131</td>
<td>1 1/16” JIC (m)</td>
</tr>
<tr>
<td></td>
<td>114609</td>
<td>1 1/16” JIC (m) x ½” JIC (m) x ½” JIC (m)</td>
</tr>
<tr>
<td></td>
<td>112132</td>
<td>3/4” JIC (m) x 3/4” JIC (m) x 3/8” BSP (m)</td>
</tr>
<tr>
<td></td>
<td>112183</td>
<td>3/8” BSP (f)</td>
</tr>
<tr>
<td></td>
<td>130076</td>
<td>¾” JIC (m) bulkhead</td>
</tr>
<tr>
<td></td>
<td>130077</td>
<td>1 1/16” JIC (m) bulkhead</td>
</tr>
<tr>
<td>Type</td>
<td>Part No.</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Elbows</td>
<td>115371</td>
<td>3/4&quot; JIC (m) x 1/4&quot; BSP (f) x ¾&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>128748</td>
<td>3/4&quot; JIC (m) x 3/4&quot; JIC (f)swv x 3/4&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>128747</td>
<td>3/4&quot; JIC (f)swv x 3/4&quot; JIC (m) x 3/4&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>128998</td>
<td>3/4&quot; JIC (f)swv x 3/4&quot; JIC (m) x 1 1/16&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>112136</td>
<td>3/4&quot; JIC (m &amp; f) swivel</td>
</tr>
<tr>
<td></td>
<td>112436</td>
<td>1 1/16&quot; JIC (m &amp; f) swivel</td>
</tr>
<tr>
<td></td>
<td>112138</td>
<td>3/8&quot; BSP (m) x 3/4&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>112134</td>
<td>3/4&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>112135</td>
<td>1 1/16&quot; JIC (m)</td>
</tr>
<tr>
<td></td>
<td>112139</td>
<td>3/8&quot; BSP (f) x 3/8&quot; BSP (f)</td>
</tr>
<tr>
<td></td>
<td>128743</td>
<td>45° 1 1/16&quot; JIC (m &amp; f) swivel</td>
</tr>
<tr>
<td></td>
<td>114567</td>
<td>45° 3/4&quot; JIC (m &amp; f) swivel</td>
</tr>
<tr>
<td></td>
<td>114632</td>
<td>45° 3/8&quot; BSP (m)</td>
</tr>
<tr>
<td></td>
<td>119336</td>
<td>3/8&quot; BSP (m)</td>
</tr>
<tr>
<td>Nozzle Bracket</td>
<td>104592</td>
<td>Size: 76x51x5 angle, 50mm width, Zinc plated</td>
</tr>
<tr>
<td>Insulated P-Clip</td>
<td>103198</td>
<td>½&quot; Hose</td>
</tr>
<tr>
<td></td>
<td>130080</td>
<td>½&quot; Hose with Hose Protector</td>
</tr>
<tr>
<td></td>
<td>103199</td>
<td>¾&quot; Hose</td>
</tr>
<tr>
<td></td>
<td>130081</td>
<td>¾&quot; Hose with Hose Protector</td>
</tr>
<tr>
<td>Weld Lug</td>
<td>129578</td>
<td>M8 Weld Lug c/w bolt and washer for mounting P-Clips</td>
</tr>
<tr>
<td>Type</td>
<td>Part No.</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Welded Clamp Blocks</td>
<td>132823</td>
<td>½” Tube</td>
</tr>
<tr>
<td></td>
<td>112113</td>
<td>¾” Hose</td>
</tr>
<tr>
<td></td>
<td>128818</td>
<td>¾” Hose</td>
</tr>
<tr>
<td></td>
<td>94435</td>
<td>Bolt on Base to suit 132823</td>
</tr>
<tr>
<td></td>
<td>130073</td>
<td>Double ½” Tube</td>
</tr>
<tr>
<td></td>
<td>130074</td>
<td>Double ¾” Hose</td>
</tr>
</tbody>
</table>

Table 14 – PEFS F3 discharge hose & tube fittings
Actuation Components

Loss of Pressure Detection Tubing

LOP tubing part number: 118837 (per metre)

LOP detection tubing has an installed life of 1 year and must therefore be replaced annually as part of the regular maintenance routine.

Manual LOP Actuator

![Figure 17 – LOP Manual Actuator](image)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>47130</td>
<td>LOP Manual Actuator</td>
</tr>
<tr>
<td>47131</td>
<td>LOP Manual Actuator – Flush Mount</td>
</tr>
<tr>
<td>28038</td>
<td>LOP Actuator Service Kit</td>
</tr>
</tbody>
</table>

Table 15 – LOP Manual Actuator Part Numbers

Electric Solenoid Valve Assembly

12V DC10W solenoid

![Figure 18- LOP solenoid valve assembly (part number ES9014-D)](image)
### Actuation System Fittings

<table>
<thead>
<tr>
<th>Type</th>
<th>Image</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼&quot; actuation hose</td>
<td>![Image](117x676 to 230x743)</td>
<td>9344220356</td>
<td>¼&quot; red coloured, ‘FIRE SUPPRESSION’ branded, oil resistant synthetic rubber with high tensile steel wire braid reinforcement meeting SAE 100R1AT specifications and U.S.MSHA 2G and AS2660 flame resistance requirements.</td>
</tr>
<tr>
<td>Hose Protector</td>
<td>![Image](129x633 to 217x671)</td>
<td>40156</td>
<td>16mm Red - Suitable for ¼&quot; hose</td>
</tr>
<tr>
<td>Hose Fittings (Field Attachable)</td>
<td>![Image](136x597 to 211x625)</td>
<td>9344220357</td>
<td>1/4&quot; Hose x 7/16” JIC (f)swv Field Attachable</td>
</tr>
<tr>
<td>Hose Fitting (Crimp)</td>
<td>![Image](145x563 to 202x590)</td>
<td>128999</td>
<td>1/4&quot; Hose x 7/16” JIC (f)swv Crimp</td>
</tr>
<tr>
<td>LOP Tubing Coupling</td>
<td>![Image](147x535 to 200x560)</td>
<td>128763</td>
<td>1/4&quot; LOP tube x 7/16”JIC (m) Compression AN Union</td>
</tr>
<tr>
<td>LOP Tubing Cap</td>
<td>![Image](154x507 to 193x532)</td>
<td>128764</td>
<td>1/4” LOP Tube EOL Compression Cap</td>
</tr>
<tr>
<td>Manifold Blocks</td>
<td>![Image](132x416 to 215x454)</td>
<td>128760</td>
<td>6 x ¼” NPT(f), 2 x 1/8” NPT(f)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128761</td>
<td>4 x ¼” NPT(f), 2 x 1/8” NPT(f)</td>
</tr>
<tr>
<td>Weld Clamp Plates</td>
<td>![Image](123x382 to 224x413)</td>
<td>128841</td>
<td>20mm ctr to ctr (to suit 6 port Manifold Block)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128842</td>
<td>33mm ctr to ctr (to suit 8 port Manifold Block)</td>
</tr>
<tr>
<td>Bolts</td>
<td>![Image](146x338 to 202x378)</td>
<td>91319</td>
<td>M6 x 35mm Hex Head (for Manifold Block)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>91320</td>
<td>M6 x 40mm Hex Head (for Manifold Block)</td>
</tr>
<tr>
<td>Tee</td>
<td>![Image](145x296 to 202x334)</td>
<td>128752</td>
<td>7/16” JIC (m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128753</td>
<td>7/16” JIC (f) x 7/16” JIC (m) x 7/16” JIC (m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128749</td>
<td>7/16” JIC (m) x 7/16” JIC (f) x 7/16” JIC (m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>112149</td>
<td>1/4” NPT (f)</td>
</tr>
<tr>
<td>Elbow</td>
<td>![Image](149x253 to 198x292)</td>
<td>114544</td>
<td>7/16” JIC (m &amp; f) swv</td>
</tr>
<tr>
<td></td>
<td></td>
<td>114568</td>
<td>45° 7/16” JIC (m &amp; f) swv</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128751</td>
<td>7/16” JIC (m) x 1/8” NPT (m)</td>
</tr>
<tr>
<td>Plug</td>
<td>![Image](150x212 to 196x247)</td>
<td>118551</td>
<td>1/8” NPT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>119568</td>
<td>1/4” NPT</td>
</tr>
<tr>
<td>Type</td>
<td>Image</td>
<td>Part No.</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
<td>----------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Nipple</td>
<td></td>
<td>112150</td>
<td>7/16” JIC Bulkhead</td>
</tr>
<tr>
<td></td>
<td></td>
<td>112148</td>
<td>1/4” NPT x 7/16” JIC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128817</td>
<td>1/8” NPT x 7/16” JIC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>118542</td>
<td>1/8” NPT</td>
</tr>
<tr>
<td>Adaptor</td>
<td></td>
<td>93696</td>
<td>1/8” BSPT x 7/16” JIC (f)swv</td>
</tr>
<tr>
<td></td>
<td></td>
<td>129579</td>
<td>¼” NPT x 7/16” JIC (f)swv</td>
</tr>
<tr>
<td>Insulated P-Clip</td>
<td></td>
<td>128819</td>
<td>¼” Tube</td>
</tr>
<tr>
<td></td>
<td></td>
<td>103197</td>
<td>¼” Hose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>103198</td>
<td>Use with Grommet 103248</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130078</td>
<td>¼” Hose with hose protector</td>
</tr>
<tr>
<td>Grommet</td>
<td></td>
<td>103248</td>
<td>Grommet to hold LOP tubing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Use with P-Clip 103198.</td>
</tr>
<tr>
<td>Weld Lug</td>
<td></td>
<td>129578</td>
<td>M8 Weld Lug c/w bolt and washer for</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mounting P-Clips</td>
</tr>
</tbody>
</table>

Table 16 – PEFS F3 pneumatic actuation hose and tube fittings

**Monitoring Components**

**Pressure Switches**

- “Cylinder low pressure”, 1550kPa NO setting DT04-3P (part number 137060)
- “Fire Alarm/Discharge”, 200kPa NC setting DT04-2P (part number 87041)

**Figure 19 – Pressure Switches**
### Identification & Instruction Labels

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Label Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>66534</td>
<td>WARNING THIS EQUIPMENT IS FITTED WITH A Chubb FIRE PROTECTION SYSTEM which may OPERATE AUTOMATICALLY AND INITIATE EQUIPMENT SHUTDOWN</td>
</tr>
<tr>
<td>66535</td>
<td>WARNING THIS EQUIPMENT IS FITTED WITH A Chubb FIRE PROTECTION SYSTEM which may OPERATE AUTOMATICALLY</td>
</tr>
<tr>
<td>66536</td>
<td>WARNING THIS EQUIPMENT IS FITTED WITH A Chubb FIRE PROTECTION SYSTEM which OPERATES MANUALLY AND INITIATES EQUIPMENT SHUTDOWN</td>
</tr>
<tr>
<td>66537</td>
<td>WARNING THIS EQUIPMENT IS FITTED WITH A Chubb FIRE PROTECTION SYSTEM which OPERATES MANUALLY</td>
</tr>
<tr>
<td>66556</td>
<td>FIRE SYSTEM MANUAL ACTUATOR TO OPERATE 1. REMOVE SAFETY PIN 2. STRIKE KNOB FIRMLY</td>
</tr>
<tr>
<td>66557</td>
<td>WARNING ISOLATE FIRE SYSTEM BEFORE ENTERING</td>
</tr>
</tbody>
</table>

Table 17 - Identification & instruction labels
APPENDIX

SDS – Chubb PEFS F3 Foam Concentrate

SAFETY DATA SHEET

CHUBB PEFS F3 FOAM CONCENTRATE

1. IDENTIFICATION

GHS Product Identifier
CHUBB PEFS F3 FOAM CONCENTRATE

Company Name
CHUBB FIRE & SECURITY

Address
316 Boundary Road Dingley
Vic 3172 Australia

Telephone/Fax Number
Tel: +61 (3) 9264 9813
Fax: +61 (03) 9264 9751

Emergency phone number
1300 369 309 (Business hours: 24/7)

Recommended use of the chemical and restrictions on use
Extinguishing fires.

2. HAZARD IDENTIFICATION

GHS classification of the substance/mixture
Classified as Hazardous according to the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) including Work, Health and Safety regulations, Australia
Not classified as Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. (7th edition)

Eye Damage/Irritation: Category 2A
Hazardous to the Aquatic Environment – Acute Hazard: Category 3
Sensitization - Skin: Category 1

Signal Word(s)
WARNING

Hazard Statement(s)
H317 May cause an allergic skin reaction.
H319 Causes serious eye irritation.
H402 Harmful to aquatic life.

Pictogram(s)
Exclamation mark

Precautionary statement – Prevention
P261 Avoid breathing dust/dust/mist/vapours/spray.
P264 Wash contaminated skin thoroughly after handling.
P272 Contaminated work clothing should not be allowed out of the workplace.
P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statement – Response
P302+P352 IF ON SKIN: Wash with plenty of soap and water.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P333+P313 If skin irritation or rash occurs: Get medical advice/attention.
P337+P313 If eye irritation persists: Get medical advice/attention.
P363 Wash contaminated clothing before reuse.

Precautionary statement – Disposal
P501 Dispose of contents/container to an approved waste disposal plant.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Name</th>
<th>CAS</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-(2-butoxyethoxy) ethanol</td>
<td>112-34-5</td>
<td>&lt;10 %</td>
</tr>
<tr>
<td></td>
<td>Anionic surfactant</td>
<td></td>
<td>&lt;3 %</td>
</tr>
<tr>
<td></td>
<td>Decyl Glucoside</td>
<td>58846-77-8</td>
<td>&lt;2 %</td>
</tr>
<tr>
<td></td>
<td>Cocamidopropyl betaine</td>
<td>61789-40-0</td>
<td>&lt;1 %</td>
</tr>
<tr>
<td></td>
<td>Amphoteric surfactant</td>
<td></td>
<td>&lt;1 %</td>
</tr>
<tr>
<td></td>
<td>3-Isothiazolone, 2-methyl-</td>
<td>2682-20-4</td>
<td>0.05% *</td>
</tr>
<tr>
<td></td>
<td>1,2-Benzisothiazol-3(2H)-one</td>
<td>2634-33-5</td>
<td>0.05% *</td>
</tr>
</tbody>
</table>

Other Information
* One or both of these components may be present at up to 0.05% as a combined total.

4. FIRST-AID MEASURES

Inhalation
If inhaled, remove affected person from contaminated area. Keep at rest until recovered. If symptoms develop and/or persist seek medical attention.

Ingestion
Do not induce vomiting. Wash out mouth thoroughly with water. Seek immediate medical attention.

Skin
Remove all contaminated clothing immediately. Wash affected area thoroughly with soap and water. Wash contaminated clothing before reuse or discard. Seek medical attention.

Eye contact
If in eyes, hold eyelids apart and flush the eyes continuously with running water. Remove contact lenses. Continue flushing for several minutes until all contaminants are washed out completely. Seek medical attention.

First Aid Facilities
Eyewash, safety shower and normal washroom facilities.

Advice to Doctor
Treat symptomatically.

Other Information
For advice in an emergency, contact a Poisons Information Centre (Phone Australia 131 126) or a doctor at once.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use appropriate fire extinguisher for surrounding environment.
Hazards from Combustion Products
Under fire conditions this product may emit toxic and/or irritating fumes including nitrous vapours, sulphur oxides, carbon monoxide and carbon dioxide.

Specific Hazards Arising From The Chemical
This product is non-combustible.

Decomposition Temperature
Not available

Precautions in connection with Fire
Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) operated in positive pressure mode. Fight fire from safe location.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures
Wear appropriate personal protective equipment and clothing to prevent exposure. Increase ventilation. If possible contain the spill. Place inert absorbent material onto spillage. Collect the material and place into a suitable labelled container. Do not dilute material but contain. Dispose of waste according to the applicable local and national regulations. If contamination of sewers or waterways occurs inform the local water and waste management authorities in accordance with local regulations.

7. HANDLING AND STORAGE

Precautions for Safe Handling
Avoid inhalation of vapours and mists, and skin or eye contact. Use only in a well ventilated area. Keep containers sealed when not in use. Prevent the build up of mists or vapours in the work atmosphere. Maintain high standards of personal hygiene by washing hands prior to eating, drinking, smoking or using toilet facilities.

Conditions for safe storage, including any incompatibilities
Store in a cool, dry, well-ventilated area, out of direct sunlight. Protect from freezing. Store in suitable, labelled containers. Keep containers tightly closed. Store away from incompatible materials. Ensure that storage conditions comply with applicable local and national regulations.

Storage Temperatures
0 - 50°C

Recommended Materials
High-density polyethylene (HDPE).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure limit values
No exposure standards have been established for the mixture. However, over-exposure to some chemicals may result in enhancement of pre-existing adverse medical conditions and/or allergic reactions and should be kept to the least possible levels.

Biological Limit Values
No biological limits allocated.

Appropriate Engineering Controls
This substance is hazardous and should be used with a local exhaust ventilation system, drawing vapours away from workers’ breathing zone. If the engineering controls are not sufficient suitable respiratory protection must be worn.

Respiratory Protection
If engineering controls are not effective in controlling airborne exposure then an approved respirator with a replaceable vapour/mist filter should be used. Reference should be made to Australian/New Zealand Standards AS/NZS 1715, Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716, Respiratory Protective Devices, in order to make any necessary changes for individual circumstances.

Eye Protection
Safety glasses with side shields, full face shield or chemical goggles should be worn. Final choice of appropriate eye/face protection will vary according to individual circumstances. Eye protection devices should conform with Australian/New Zealand Standard AS/NZS 1337 - Eye Protectors for Industrial Applications.
Hand Protection
Wear gloves of impervious material such as butyl rubber. Final choice of appropriate gloves will vary according to individual circumstances. i.e. methods of handling or according to risk assessments undertaken. Occupational protective gloves should conform to relevant regulations. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance.

Body Protection
Suitable protective workwear, e.g. cotton overalls buttoned at neck and wrist is recommended. Chemical resistant apron is recommended where large quantities are handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>Liquid</td>
<td>Appearance</td>
<td>Liquid</td>
</tr>
<tr>
<td>Colour</td>
<td>Brown</td>
<td>Odour</td>
<td>Mild</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>Not available</td>
<td>Melting Point</td>
<td>0°C</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>100°C</td>
<td>Solubility in Water</td>
<td>Completely</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.05 (20°C)</td>
<td>pH</td>
<td>7.0-8.5 (100%)</td>
</tr>
<tr>
<td>Vapour Pressure</td>
<td>24 hPa (20°C)</td>
<td>Vapour Density (Air=1)</td>
<td>1</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not available</td>
<td>Odour Threshold</td>
<td>Not available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not available</td>
<td>Volatile Component</td>
<td>Not available</td>
</tr>
<tr>
<td>Partition Coefficient: n-octanol/water</td>
<td>Not available</td>
<td>Flash Point</td>
<td>Not available</td>
</tr>
<tr>
<td>Flammability</td>
<td>Not flammable</td>
<td>Auto-Ignition Temperature</td>
<td>Not available</td>
</tr>
<tr>
<td>Flammable Limits - Lower</td>
<td>Not available</td>
<td>Flammable Limits - Upper</td>
<td>Not available</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Reactivity
Not available

Chemical Stability
Stable under normal conditions of handling and storage.

Conditions to Avoid
Extremes of temperature. Heat sources.

Incompatible materials
Not available

Hazardous Decomposition Products
Thermal decomposition may result in the release of toxic and/or irritating fumes, smoke and gases including nitrous vapours, sulphur oxides, carbon monoxide and carbon dioxide.

Possibility of hazardous reactions
Not available

Hazardous Polymerization
Not available

11. TOXICOLOGICAL INFORMATION

Toxicology Information
The available toxicity data is given below.

Acute Toxicity - Oral
Product:
LD50 (rat): >2000 mg/kg
2-(2-butoxyethoxy) ethanol
LD50 (rat): 2410 mg/kg

Acute Toxicity - Dermal
2-(2-butoxyethoxy) ethanol:
LD50 (rat): 2764 mg/kg

Ingestion
Ingestion of this product may irritate the gastric tract causing nausea and vomiting.

Inhalation
Inhalation of product vapours may cause irritation of the nose, throat and respiratory system.

Skin
May be irritating to skin. The symptoms may include redness, itching and swelling. May cause an allergic skin reaction.

Eye
Causes serious eye irritation. On eye contact this product will cause tearing, stinging, blurred vision, and redness. 
Product (Rabbit): Moderately irritating.

Respiratory sensitisation
Not expected to be a respiratory sensitiser.

Skin Sensitisation
May cause an allergic skin reaction.

Germ cell mutagenicity
Not considered to be a mutagenic hazard.

Carcinogenicity
Not considered to be a carcinogenic hazard.

Reproductive Toxicity
Not considered to be toxic to reproduction.

STOT-single exposure
Not expected to cause toxicity to a specific target organ.

STOT-repeated exposure
Not expected to cause toxicity to a specific target organ.

Aspiration Hazard
Not expected to be an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicity
Harmful to aquatic life.

Persistence and degradability
Readily biodegradable in water.
Biological Oxygen Demand (BOD): 73% (28 days, OECD 301D)

Mobility
Soluble in water. Volatile Organic Compounds (VOC): 0%

Bioaccumulative Potential
Components:
log Pow: <3
Not bioaccumulative

Other Adverse Effects
Not dangerous to the ozone layer. Harmless to activated sludge at sufficient dilution.

Environmental Protection
Prevent this material entering waterways, drains and sewers.

Acute Toxicity - Fish
LC50 (Salmo gairdneri/Onchorhynchus Mykiss): 42 mg/l/96h
EC50 (Fundulus Heteroclitus - Slatwater Killifish): 150 mg/l/96h

Acute Toxicity - Daphnia
EC50 (Daphnia Magna): 644 mg/l/48h

Acute Toxicity - Algae
EC50 (Selenastrum Capricornutum): >6.9 mg/l/96h

13. DISPOSAL CONSIDERATIONS

Disposal considerations
Dispose of waste according to applicable local and national regulations.

Other Information
Contains no organic halogen which may add to the AOX value.

14. TRANSPORT INFORMATION

Transport Information
Road and Rail Transport (ADG Code):

Marine Transport (IMO/IMDG):
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea.

Air Transport (ICAO/IATA):
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air.

U.N. Number
None Allocated

UN proper shipping name
None Allocated

Transport hazard class(es)
None Allocated

Special Precautions for User
Not available

IMDG Marine pollutant
No

Transport in Bulk
Not available

15. REGULATORY INFORMATION

Regulatory Information
Classified as Hazardous according to the Globally Harmonised System of Classification and labelling of Chemicals (GHS) including Work, Health and Safety regulations, Australia.
Not classified as a Scheduled Poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

Poisons Schedule
Not Scheduled

16. OTHER INFORMATION

Date of preparation or last revision of SDS
SDS Created: April 2017
References
Preparation of Safety Data Sheets for Hazardous Chemicals Code of Practice.
Standard for the Uniform Scheduling of Medicines and Poisons.
Australian Code for the Transport of Dangerous Goods by Road & Rail.
Model Work Health and Safety Regulations, Schedule 3A: Prohibited carcinogens, restricted carcinogens and restricted hazardous chemicals.
Workplace exposure standards for airborne contaminants.
Adopted biological exposure determinants, American Conference of Industrial Hygienists (ACGIH).
Globally Harmonised System of classification and labelling of chemicals.

END OF SDS

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# AS2337 Cylinder Visual Inspection Damage Limits

<table>
<thead>
<tr>
<th>Name</th>
<th>Definitions and illustrations (with limits)</th>
<th>Limits and treatment</th>
<th>General</th>
<th>C23</th>
<th>C30</th>
<th>C45</th>
<th>C65</th>
<th>C106</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulge</td>
<td>A swelling of the cylinder or vessel wall.</td>
<td>Condemn where measured circumference varies by more than 1% between any two similar sections of the cylinder.</td>
<td></td>
<td>Variance 6.9mm</td>
<td>Variance 10.1mm</td>
<td>Variance 11.4mm</td>
<td>Variance 11.4mm</td>
<td>Variance 11.4mm</td>
</tr>
<tr>
<td>Dent</td>
<td>A blunt impression where the surface material has not been penetrated.</td>
<td>Condemn where— (a) the depth of dent exceeds 10% of the average dent diameter (b) the average diameter of dent exceeds 25% of the cylinder diameter; or (c) the dent impinges on a weld and it exceeds 6.5 mm in depth. Average dent diameter D is taken to be (y + x)/2.</td>
<td>Dent OD 55mm</td>
<td>Dent OD 80.5mm</td>
<td>Dent OD 91mm</td>
<td>Dent OD 91mm</td>
<td>Dent OD 91mm</td>
<td></td>
</tr>
<tr>
<td>Dig</td>
<td>A sharp impression where the surface material has not been penetrated.</td>
<td>Condemn where length of dig exceeds 75 mm, or the depth of the dig exceeds 25% of the original wall thickness.</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td></td>
</tr>
<tr>
<td>Cut (gouge)</td>
<td>A sharp impression where the surface material has been penetrated.</td>
<td>Condemn where the length of cut exceeds 75 mm, or the depth of the cut exceeds 25% of the original wall thickness.</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td></td>
</tr>
<tr>
<td>Pit</td>
<td>Local corrosion which does not exceed 6.5 mm mean diameter and is not nearer than 85 mm to any other local corrosion.</td>
<td>Condemn where depth of the pit is greater than 50% of original wall thickness. Where the distance between adjacent pits is less than 85 mm, treat as general corrosion.</td>
<td>Depth 1mm</td>
<td>Depth 1mm</td>
<td>Depth 1mm</td>
<td>Depth 1mm</td>
<td>Depth 1mm</td>
<td></td>
</tr>
<tr>
<td>Line corrosion or linear wear or abrasion</td>
<td>Corrosion in a line and not wider than 6.5 mm at the surface.</td>
<td>Condemn where the length exceeds 75 mm, or the depth exceeds 25% of the original wall thickness.</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td></td>
</tr>
<tr>
<td>General corrosion</td>
<td>Any corrosion more extensive than pit or line corrosion.</td>
<td>Condemn where mass check in accordance with AS2337.1 Section 8 is failed, or where depth of corrosion exceeds 25% of the original wall thickness.</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td>Depth 0.5mm</td>
<td></td>
</tr>
<tr>
<td>Cracks</td>
<td>Any crack, rift in the metal.</td>
<td>Condemn (see AS2337.1 Appendix H)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas leakage</td>
<td>Any gas leakage through the cylinder, or at the valve due to damaged or worn cylinder neck threads.</td>
<td>Condemn where any leak is detected. Where leakage is suspected, the cylinder shall be pressured to working pressure and either submerged in a water bath or bathed with soapy water, and observed to determine whether or not leakage occurs. Cylinders which have leakage due to damage to threaded openings may be repaired, provided that this is permitted by AS2030.1 and the cylinder specifications. Otherwise, such cylinders shall be condemned.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burns</td>
<td>A localized heat-affected region of the cylinder wall.</td>
<td>Where surface damage is evident, either the cylinder shall be condemned or the affected surface ground smooth and any remaining cuts and pits treated in accordance with 'cut (gouge)' and 'pit'. Where the limits are not exceeded, the cylinder shall then be re-he treated in accordance with AS2337.1 Clause 9.4, and then hydraulically pressure tested in accordance with AS2337.1 Section 7. For cylinders with heat affected regions but no evidence of surface damage, treat as fire damaged as specified in 'Fire damage' below.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Fire and heat damage

Any damage resulting from a fire or excessive or unusual application of heat.

Condemn where —
- (a) warping or distortion is evident;
- (b) bulging exceeds limits specified for a bulge; or
- (c) there is evidence of damage from excessive heat.

Where a steel cylinder has not suffered damage to the extent specified in (a), (b), or (c) above, but has burned areas exceeding 6000 mm², it shall either be re-heat treated and tested where appropriate, in accordance with the original manufacturing specification, and hydraulically pressure tested in accordance with AS2337.1 Section 7, or shall be condemned.

Where the burned areas of a steel cylinder do not exceed 6000 mm², the cylinders may be returned to service.

### Cylinder Neck

Cylinder neck inspection includes both external and internal inspections of the neck area. The cylinder to valve thread of the cylinder shall be examined to ensure that it is—
- (a) clean and of full form;
- (b) free of significant damage;
- (c) free of burrs;
- (d) free of cracks; and
- (e) free of other significant imperfections that would affect the integrity of the connection.

Condemn where the neck thread shows evidence of cracks, damage or excessive wear except where gauging with a thread gauge complying with AS2473 shows the thread to be satisfactory.

<table>
<thead>
<tr>
<th>Name</th>
<th>Definitions and illustrations (with limits)</th>
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</thead>
</table>
| Fire and heat damage | Any damage resulting from a fire or excessive or unusual application of heat.                               | Condemn where —
|                   |                                                                                                          | (a) warping or distortion is evident;                                                |
|                   |                                                                                                          | (b) bulging exceeds limits specified for a bulge; or                                  |
|                   |                                                                                                          | (c) there is evidence of damage from excessive heat.                                  |
|                   |                                                                                                          | Where a steel cylinder has not suffered damage to the extent specified in (a), (b), or (c) above, but has burned areas exceeding 6000 mm², it shall either be re-heat treated and tested where appropriate, in accordance with the original manufacturing specification, and hydraulically pressure tested in accordance with AS2337.1 Section 7, or shall be condemned. Where the burned areas of a steel cylinder do not exceed 6000 mm², the cylinders may be returned to service. |
| Cylinder Neck      | Cylinder neck inspection includes both external and internal inspections of the neck area. The cylinder to valve thread of the cylinder shall be examined to ensure that it is—
|                   |                                                                                                          | (a) clean and of full form;                                                          |
|                   |                                                                                                          | (b) free of significant damage;                                                      |
|                   |                                                                                                          | (c) free of burrs;                                                                  |
|                   |                                                                                                          | (d) free of cracks; and                                                             |
|                   |                                                                                                          | (e) free of other significant imperfections that would affect the integrity of the connection. |
|                   |                                                                                                          | Condemn where the neck thread shows evidence of cracks, damage or excessive wear except where gauging with a thread gauge complying with AS2473 shows the thread to be satisfactory. |