TRIPLE P PROJECTS LTD
SD200 FIRE PRESSURE ENHANCING PUMP FUNCTION TESTS

Witnessed by

Warrington Certification Ltd
Holmesfield Road
Warrington
WA1 2DS

With respect to

THE VALIDATION OF COMPLIANCE

to

THE LPC RULES FOR AUTOMATIC SPRINKLER INSTALLATIONS 2009 INCORPORATING BS EN 12845

Produced by:

Mr R Hammond

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1. FORWARD

At the request of Triple P Projects Ltd, Exova Warrington Fire Ltd has undertaken an independent assessment and witnessed a series of function tests on an example of their SD200 town's main pressure enhancing pump units. The function tests were carried out at their premises at Unit 8A, Former TRW Works, Resolven, Neath, SA11 4HN on the 10th December 2014.

The validation assessment and function tests were instigated to gain a third party verification as to the compliance of the SD200 pump series with the Loss Prevention Rules for Automatic Sprinkler Installations 2009 incorporating BS EN 12845. The brief of Exova Warrington Fire Ltd was to evaluate the suitability for compliance; to witness the function tests and to provide independent third-party commentary on the results observed. Exova Warrington Fire Ltd was not a party to the initial determination of the test protocols, but did attend a preliminary works demonstration on the 6th November 2014 to determine and confirm their suitability.

During this visit, Ray Hammond of Exova Warrington Fire inspected the test arrangement in attendance with Huw Davies and Robert Guy of Triple P Projects Ltd. The proposed procedure for the testing was demonstrated, discussed and its suitability agreed by all parties.

The function tests were agreed in order to demonstrate that the SD200 pump unit will only operate within a preset design envelope so as to:

- Start automatically under minimum head flowing conditions when necessary.
- Prevent negative pressures within a Town's Main.
- To safeguard over-pressurising of a sprinkler system in the event of high towns Main pressures.
- To maintain a system's demand where a supply was found to be below the minimum requirements.
- To maintain a system's demand where a supply was found to be fluctuating during operation.

2. OVERVIEW OF THE SD200 SERIES PUMP UNITS

The SD200 range of pump units have been designed specifically to overcome problems where the Town's Main water supply pressure has been reduced or simply cannot meet the needs of a sprinkler system. This is frequently as a result of water management policies designed to minimise water wastage. The full SD200 range of pump units is advised to be WRAS approved and fully compliant with water company regulations and byelaws.

The pump unit comprises of a skid 1000mm long x 750mm wide x 1200mm high containing an LPCB approved close coupled electric motor driven end

suction type sprinkler pump, appropriately sized suction connection, delivery discharge pipe complete with WRAS approved backflow prevention valve, dual pressure switch automatic sprinkler pump and independent pressure maintenance pump start arrangements and controller.

Each unit is individually manufactured to suit a sprinkler systems design demand as specified within the LPC Rules for the appropriate occupancy hazard. The required sprinkler pump nominal rating is selected based on compliance with Table-6 of BS EN 12845 as follows:

Hazard Class (Wet systems)	Flow	Pressure	Maximum demand flow	Pressure
Light (LH)	225 L/min	2.2bar+*ps*	-	-
Ordinary (OH1)	375 L/min	1.0bar+*ps*	540 L/min	0.7bar+*ps*
Ordinary (OH2)	725 L/min	1.4bar+*ps*	1000 L/min	1.0bar+*ps*
Ordinary (OH3)	1100 L/min	1.7bar+*ps*	1350 L/min	1.4bar+*ps*
Note: *ps* is the static head loss based on the highest sprinkler elevation in increments of 15m, 30m or 45m as prescribed for BS EN 12845 pre-calculated sprinkler system pump characteristics.				

Although the default pump characteristics are based on pre-calculated system parameters, it is understood that fully hydraulically calculated designed systems can be accommodated.

Design intentions of the SD200 pump unit are given as:

- Designed to pass through all standard door openings.
- To comprises a small footprint to aid installation in congested areas.
- To free up the space that would normally be required for a water storage tank or tanks.
- To alleviate space problems in such locations as urban built-up areas, retail stores, offices and retro-fit situations.
- Its soft-start eliminates issues associated with water hammer.
- Significantly lower power requirements than standard fire pumps of the same duty.
- Incorporates electrical power overload prevention control.
- Utilises a standard LPCB approved fire pump and LPCB approved ancillary components where appropriate.
- Provides full protection to the Town's Main in respect of low suction pressures.
- Incorporates 'system over pressurisation protection'.
- Maintains low pump pipe-work pressures when in the standby mode.

- Full backflow prevention using WRAS approved equipment.
- Fitted with all standard signalling facilities as specified by the LPC Rules for the installation of sprinkler systems incorporating BS EN 12845.
- Will only operate under conditions where the systems flow/pressure demand exceeds the town mains capability.

3. COMPLIANCE WITH THE LPC RULES INCORPORATING BS EN 12845: 2009

To assess compliance, the relevant BS EN Clauses and Technical Bulletins were identified and catalogued in to two categories as listed below:

Clauses pertinent to contractors installing a SD200 pump unit.

BS EN 12845: Section 9,2: Town Mains. (No equivalent Technical Bulletin).
Clauses 9.2.1 and 9.2.2: general and boosted mains
BS EN 12845: Section 10.3: Compartments for pump-sets. (TB210).
Clause 10.3.1: 10.3.2: 10.3.3: general, protection and temperature.
Clause 10.5: valves and accessories and bypass arrangement
BS EN 12845: Section 10.6: Suction conditions. (TB210).
Clause 10.6.2.1: suction pipe general
Clause 10.6.2.5: pressure maintenance pump
BS EN 12845: Section 10.7: Performance characteristics. (TB210).
Clause 10.7.4: pressure and capacity of boosted town mains
BS EN 12845: Section 10.8: Electrically driven pump-sets. (TB210).
Clause 10.8.1.1: 10.8.2.1: 10.8.2.2: 10.8.3.1 and 10.8.3.2: 10.8.4: electrical supply

The above clauses are considered pre-requisite requirements incumbent on the installing contractor to ensure compliance.

Clauses specifically pertinent to the SD200 range of pump units.

BS EN 12845: Section 10: Pumps. (TB210).
Clause 10.1: general
Clause 10.5: venting, cooling and pressure gauge tappings
BS EN 12845: Section 10.6.2: Suction pipe. (TB210).
Clause 10.6.2.1: Table 14
BS EN 12845: Section 10.7: Performance characteristics. (TB210).
Clause 10.7.5.1: 10.7.5.2: 10.7.5.3: pressure switches
BS EN 12845: Section 10.8: Electrically driven pump-sets. (TB210).
Clause 10.8.1.2: 10.8.2.1: documentation and fuses
Clause 10.8.5.1: 10.8.6.2: 10.8.5.3: pump controller
Clause 10.8.6.1: 10.8.6.2: 10.8.6.3: monitoring of pump operation.

The SD200 range of pressure enhancing pumps has been reviewed in context with the above clauses and is considered validated as in full compliance with the requirements of the LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845: 2009.

4. FUNCTION TEST ARRANGEMENT CONFIGURATION

The test arrangement has been purposely designed and constructed in order to emulate the variable flow/pressure environment of a town's main supply. This includes catastrophic loss of supply, low pressure, high pressure and fluctuating pressure conditions.

Water for the tests was contained in storage tank with a high water level of approximately 2.5m above the centreline of the SD200 unit's suction connection giving a un-assisted static pressure less than the minimum 0.5bar threshold of BS EN 12845, Clause 10.7.4. To enable changeable flow/pressure control, the suction connection from the water storage tank is fitted with a variable speed electric motor driven pump. This suction pump is LPCB rated for OH3-15metre occupancies with a nominal duty of 2250L/min at 1.4bar

Downstream of the suction pump, the suction connection was fitted with a suction pressure gauge and a 65mm NB bypass arrangement complete with two isolating valves and a flexible hose section mounted between them.

The example SD200 pressure enhancement unit tested was similarly rated as the water supply suction pump to suit an OH3-15metre requirement at 1100L/min @ 3.2 bar and 1350L.min @ 2.9bar.

The delivery discharge pipe-work from the SD200 pressure enhancing unit was routed back to the water storage facility in the configuration of a BS EN 12845 standard pump test return pipe with the additional facility to emulate a single or multiple progressive sprinkler head operation. To monitor and control test flow rates the test return pipe was fitted with an LPCB approved flow meter.

SD200 PRESSURE ENHANCING PUMP FUNCTION TEST ARRANGEMENT

5. FUNCTION TEST AIMS, PROCEDURE & CONCLUSIONS

The following function tests were agreed at the preliminary works demonstration held on the 6th November 2014 as being appropriate to demonstrate the principle aims of the SD200 pressure enhancement pump and it's capabilities.

1. Undertake an automatic start by simulating a single sprinkler operation.
2. Demonstrate no loss of positive suction pressure.
3. Emulate a high town's main pressure and demonstrate the system over- pressure safeguard.
4. Establish that the unit maintains a system's flow/pressure demand where the supply is below the minimum requirements.
5. Show its ability to maintain a system's flow/pressure demand where a supply was found to be fluctuating during operation
6. Simulate power loss when the unit is on full load.
7. Simulate power loss when the unit is in standby mode.

Prior to carrying out the function tests, the suction connection was verified as fully open with the 65mm flexible bypass isolated and the water supply suction pump switched off. The suction gauge was noted to indicate 0.25bar and the "sprinkler system" delivery pipe pressurised to a nominal 4.9bar standing pressure. The SD200 unit's maximum pressure was verified as pre-set and limited to 5.0bar and the unit confirmed to be in normal standby mode.

1. Automatic start

The water supply "town's main" suction pump was manually started and set to deliver a nominal 1.0bar as measured on the suction pressure gauge**.**

The single sprinkler test valve mounted to the pump test return pipe was opened, and the delivery pressure reduced.

When the "system" pressure dropped to approximately 4.0bar, the SD200 unit was noted to automatically start bringing the "system" pressure back up to 5.0bar. The suction pressure remained steady at 1.0bar.

The test valve was closed and the system pressure stabilised at 5.15bar churning pressure.

Conclusion: automatic start under minimum flowing conditions verified.

2. Loss of positive suction pressure

The water supply "town's main" suction pump was manually re-set to deliver a nominal 2.0bar as measured on the suction pressure gauge. The SD200 unit's delivery pressure was recorded to remain balanced at 5.15bar.

The main pump test return valve was opened until a stabilised flow rate of 1100lpm through the flow meter was achieved. The delivery pressure was noted to remain at 5.15bar with the suction pressure dropping to 1.4bar.

The water supply "town's main" suction pump was then manually shut down, reducing the suction pressure to only the 0.25bar available due to the head of water within the storage tank.

The SD200 unit was observed to immediately slow down in order to preserve positive suction pressure.

At this point, the 65mm bypass isolating valves were opened and the main suction pipe stop valve closed, thus diverting all the suction flow through the bypass and flexible hose section. No discernable collapsing of the hose was observed confirming that positive suction pressure had been retained.

Conclusion: positive suction pressure retention verified.

3. System over-pressure safeguard at high suction pressures

The water supply "town's main" suction valve was re-opened, the 65mm bypass isolated and the water supply pump re-started. The SD200 unit returned back to the previous setting of delivering 1100L/min at 5.15 bar and the suction pressure to 1.4bar.

The pump test return valve was closed bringing the system back to a closed valve status. The churning pressure remained constant at 5.15bar with the SD200 unit still running.

The water supply "town's main" suction pump speed was adjusted to its maximum setting and the suction pressure increased to 4.0bar.

The SD200 unit's speed was noted to automatically slow down with the system delivery pressure still remaining constant at 5.15bar.

Conclusion: system over-pressure safeguard confirmed.

4. Maintaining a systems flow/pressure demands

The water supply "town's main" suction pump speed was re-adjusted to its previous setting of delivering 2.0bar as measured on the suction pressure gauge. It was agreed that this "standing" pressure was a reasonable reflection of a poor town's main supply.

The main pump test return valve was again slowly opened until the previous stabilised flow rate of 1100lpm through the flow meter was achieved. The SD200 unit again maintained the delivery pressure at 5.15bar with the suction pressure dropping to the same 1.4bar as previously recorded under tests 2 & 3 confirming consistent repeatability.

The test return valve was further opened until the stabilised flow rate of 1350lpm through the flow meter was achieved. The suction pressure was observed to decrease to 1.0bar and the delivery pressure to 4.45bar.

Whilst checking the suction pressure, the main pump test return valve was slowly opened further until the suction pressure was noted to drop to 0,5bar. At this point the SD200 unit automatically slowed down whilst maintained a delivery flow of 1500L/min. Further opening of the test valve resulted in the suction pressure dropping to below the 0.5bar threshold and the SD200 unit dropped to safeguard mode again preserving the remaining suction pressure.

Based on the SD200 unit rating to suit OH3 -15metre, the BS EN 12845: Table-6 flow/pressure requirements of 1100L/min @ 3.2bar and 1350L/min @ 2.9bar were satisfactorily met. Adding the available suction pressures recorded, the minimum pressures to be achieved were calculated as 3.2b + the suction pressure of 1.4bar, (4.6bar), and 2.9b + 1.0b, (3.9bar), at 1100L/min and 1350L/min respectfully.

The pressures actually achieved of 5.15b and 4.45b confirmed satisfaction of tan OH3-15metre system requirements.

Conclusion: Maintaining a systems flow/pressure demands confirmed

5. Fluctuating suction conditions

Whilst still operating in safeguard mode, the water supply "town's main" suction pump speed was re-adjusted to raise the suction pressure sufficient to clear the 0.5bar minimum threshold and the SD200 unit automatically returned back to meeting the "systems" demand requirements. Varying the suction

pressure further had little observable affect and the “systems” demands were maintained.

The test return valve was fully closed and the previous suction pressure adjusted back to the 2.0bar setting.

Conclusion: Fluctuating suction conditions satisfied.

6. Power loss under full load.

The test return valve was opened until the stabilised flow rate of 1350lpm through the flow meter was achieved.

The electric supply to the SD200 unit was isolated in simulation of a power loss.

The SD200 unit shut down and the fault alarm initiated.

The electric supply to the SD200 unit was reinstated and the unit re-started and resumed operating as it was prior to the power loss.

The test return valve was fully closed and the SD200 unit manually shut down.

Conclusion: normal re-instatement following a power loss under load verified

7. Power loss on standby.

The SD200 unit was verified as in normal standby mode.

The electric supply to the SD200 unit was isolated in simulation of a power loss.

The SD200 unit shut down and the fault alarm initiated.

The electric supply to the SD200 unit was reinstated and the unit returned back to the same status as it was prior to the power loss.

Conclusion: standby status re-instated following a power loss verified

6. SUMMARY

In summary, the SD200 unit is considered to have satisfactorily demonstrated its ability to meet all function test requirements and is judged as in full compliance with the requirements of the LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845: 2009.

It is validated as an approved water supply option for the purposes of a third party Certification of Conformity under the FIRAS Commercial & Industrial Sprinkler Installers scheme provided the installing contractor fully adheres to those LPC clauses identified as their responsibility in Section-3 of this report.

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