Installation Guide

Installation Guide

SAVE THESE INSTRUCTIONS –This manual contains important instructions for ZJBENY **Rapid Shutdown System Equipment** that shall be followed during installation and maintenance of the Rapid Shutdown System Equipment, BFS-11, BFS-12, BFS-ESW11, BFS-ESW21, BFS-ESW11–K and BFS-ESW21–K.

DISCLAIMER

FCC

This equipment has been tested and verified to be in compliance with the limits for FCC CFR47 part 15.107 Class B – Conducted Emissions and FCC CRF47 Part 15.109 Class B – Radiated Emissions, to provide reasonable to provide reasonable protection against harmful interference for unlicensed premises. This equipment generates and can radiate radio frequencies, and if not installed in accordance with the instructions, may cause interference with radio communications; should such interference occur then consider relocation of the product in order to increase the separation between the equipment.
Alterations not approved by the compliance authority may void the user's authority to operate this equipment.

SAFETY SYMBOLS

Please contact the below concerning technical questions about this product:-

Warning - Failure to heed this the information indicated by this symbol may lead to dangerous conditions, possibly resulting in death or serious bodily injury.

Caution - Failure to heed this the information indicated by this symbol may lead to dangerous conditions, possibly resulting in minor or light bodily injuries and/or substantial property damage.

Information - Denotes important information about safety issues.

Note - Denotes additional information.

SAFETY INSTRUCTIONS

The BFS is an electrical product and should only be installed by a suitably qualified person, in accordance with local regulations such as BS7671 (UK) and ANSI/NFPA70 (USA).

When modifying and existing installation, isolate the inverter from the PV array by turning OFF the DC isolator / switch disconnect or turn OFF the inverter and the AC switch.

PV Panel input and output connectors are not environmentally sealed until they are mated. Disconnected connectors should be plugged into an appropriate mating part or used with suitable watertight caps.

BFS DC input and output connectors are not environmentally sealed until they are mated. Disconnected connectors should be plugged into an appropriate mating part or used with suitable watertight caps.

The BFS is fitted with Multi Contact MC4（KBT4/KST4） connectons and to maintain UL connector approval listings these should only be mated with their counterpart connector. PV connectors should not be connected or disconnected under load.

Incorrect connections to the BFS may cause failure.

CAUTIONS

Installation of the BFS without ensuring compatibility of the module\inverter connectors with the BFS connectors may be unsafe and cause operational problems. For mechanical compatibility of the modules\inverter and the BFS, use identical connectors from the same manufacturer on both the BFS and modules, or obtain verification that the connectors to be used are compatible.

If the BFS is to be mounted directly to the PV frame or module, obtain guidance from the module manufacturer regarding it's location and also verify the impact on the module warranty.

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INTRODUCTION

The BFS product is Rapid Shut Down Equipment for connection to PV panel arrays in order to achieve compliance to 2014 NEC 690.12 and 2017 NEC 690.12.

The BFS automatically shuts down array output to the PV inverter when it detects a temperature in excess to 85°C (BFS-11) and 92°C (BFS-12): this function was not evaluated by UL).

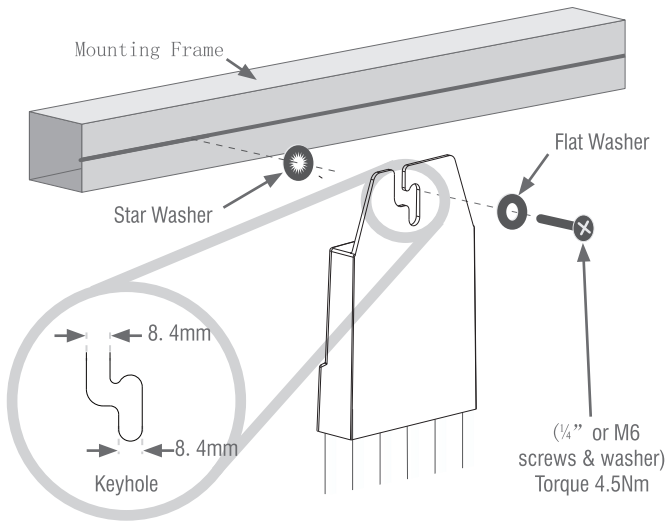
The BFS can be installed without any set-up and with any string inverter as its functionality is completely independent. “Plug & Play” style installation using industry standard connectors makes the BFS for new installations as well as retro-fit; and its mains powered independent DC power supply and emergency switch unit allows flexibility for positioning for user convenience giving Manual Emergency Shutdown, as well responding to local or area grid shutdown.

PARTS

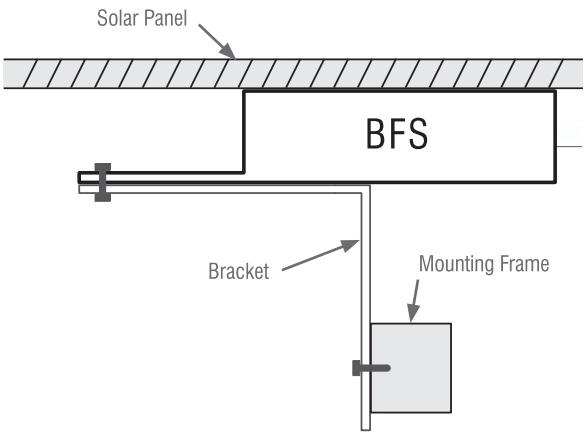
BFS-11	BFS Rapid Shutdown System Unit
BFS-12	BFS Rapid Shutdown System Unit with Fire Monitoring & Integration Options
BFS-ESW11	Emergency Rapid Shutdown Switch Unit (for BFS-11)-includes 24 VDC power supply
BFS-ESW12	Emergency Rapid Shutdown Switch Unit (for BFS-11)-includes 24 VDC power supply
BFS-ESW21	Emergency Rapid Shutdown Switch Unit (for BFS-12)-includes 24 VDC power supply
BFS-ESW11-K	Emergency Rapid Shutdown Switch Unit with Key Lock (standard key) for BFS-11- includes 24 VDC power supply
BFS-ESW12-K	Emergency Rapid Shutdown Switch Unit with Key Lock (standard key) for BFS-11- includes 24 VDC power supply
BFS-ESW21-K	Emergency Rapid Shutdown Switch Unit with Key Lock (standard key) for BFS-12- includes 24 VDC power supply

INSTALLATION & CONNECTION

One BFS will control two solar panels and for compliance with 2017 NEC it should be mounted within the array boundary of the two panels, where the two panels are no greater than 1’ (foot) /30cm apart from each other.
Determine the mounting location of the BFS (BFS-11 or BFS-12) and fix as shown below.



Mounting Method 1



Mounting Method 2

Do not drill through the BFS as this will damage the unit and prevent operation.

Mounting Method 1 offers ease of fixing whilst Mounting Method 2 can be used where more effective use of the BFS’s onboard temperature sensing is required, by placing the BFS in position against the underside of the PV panel (or the surface where the temperature needs to be sensed). Once mounted ensure that the BFS is secure.

The BFS is housed in a plastic enclosure therefore grounding of the product is unnecessary

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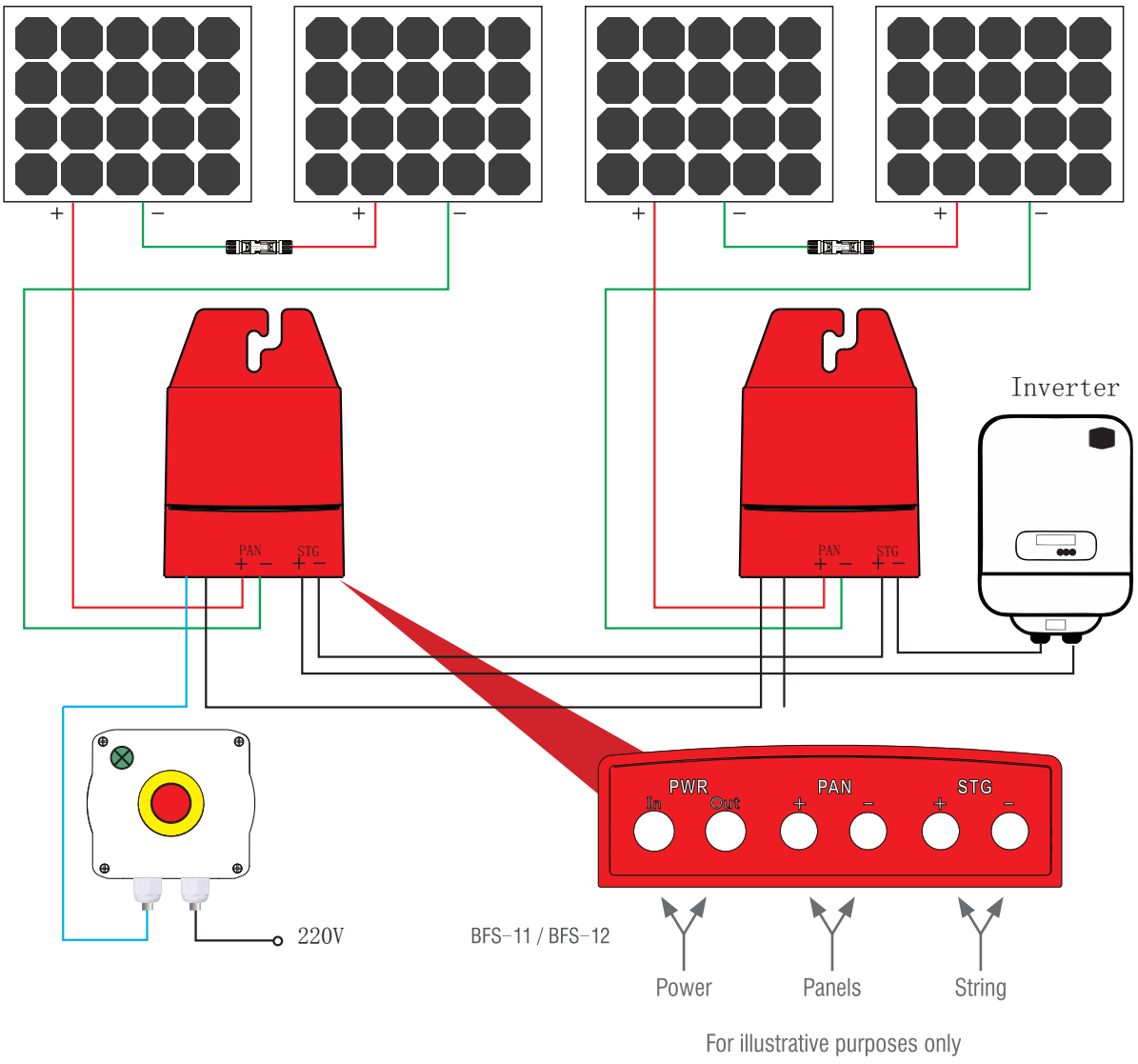
BFS-1/BFS-2 INSTALLATION

Connect the two PV panels in series (typical wiring example below). Connect the array Positive (+) output connector to the BFS Positive (+) input connector. Connect the array Negative (-) output connector to the BFS Negative (-) input connector.



For illustrative purposes only

For NEC 2017 compliance PV panels should be <40V.

Warning - Ensure that you have identified the inputs correctly. The BFS input cables are the shorter ones.

Connect the BFS's two output cables to the DC isolator/Solar Inverter ensuring that the correct polarity is maintained throughout the electrical wiring.

The BFS is OFF giving no array output until such time as the external DC power supply is energised and the Emergency Switch is in its non-activated position.

EMERGENCY RAPID SHUTDOWN SWITCH INSTALLATION

The Emergency Rapid Shutdown Switch Unit (BFS-ESW11 / BFS-ESW21 / BFS-ESW11-K / BFS-ESW21-K) hereafter referred to as BFS-ESW11, for installation; can be conveniently located anywhere for emergency access and is supplied with an internal 24VDC power supply to interface with the BFS units.

Locate a convenient position for mounting the BFS-ESW11 unit ensuring that mains power connection is also available. Before mounting ensure that the cable entry/exit gland positions are accessible.

Remove the BFS-ESW11 cover taking care not to damage the switch or power supply contained within the BFS-ESW11 enclosure. Insert cable glands (supplied) into position, ensuring that the sealing washer (where supplied) is between the main gland body and the outer enclosure surface, screw the gland into position and then tighten securing/locking nut.

The max distance allowed from button switch to RSD: 150M.

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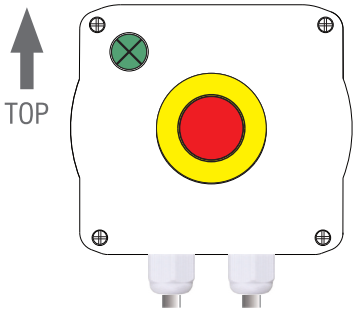
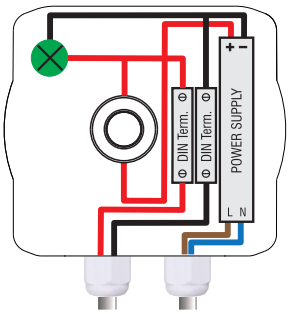
The BFS-ESW11 should be connected in accordance with local wiring regulations (e.g. IET for UK, NEC for USA, CEC for Canada).



Installation Orientation



BFS-ESW11

Using appropriate fixings attach the BFS-ESW11 unit vertically to the chosen surface.

Mounting the BFS-ESW11 non-vertically will invalidate warranty.

Connect the mains supply wire to the BFS-ESW11 power supply L and N (Live and Neutral) terminals using suitably rated 2-core cable (refer Technical Specifications section for electrical details) ensuring correct polarity of connections. Verify secureness of cables.

Strip AC mains wire length 4-5mm. Terminal tightening torque 0.5Nm (4.5lb-in).

Power Supply can be unclipped from the DIN-Rail for easier wiring.

Connect suitably rated 2x1mm2 cable, one wire to the black wired DIN terminal Negative (-) terminal and with other wire to the red wired DIN terminal; this will be 24VDC Positive (+) wire. Terminate the remote end with a Communication SuperSeal 2-pole socket (female) ensuring correct polarity of connections
[Communication connector: pin 1 Positive (+24VDC), pin 2 Negative (0VDC)].

Strip 24V DC wire length 10mm. DIN terminal tightening torque 0.5Nm (4.5lb-in).

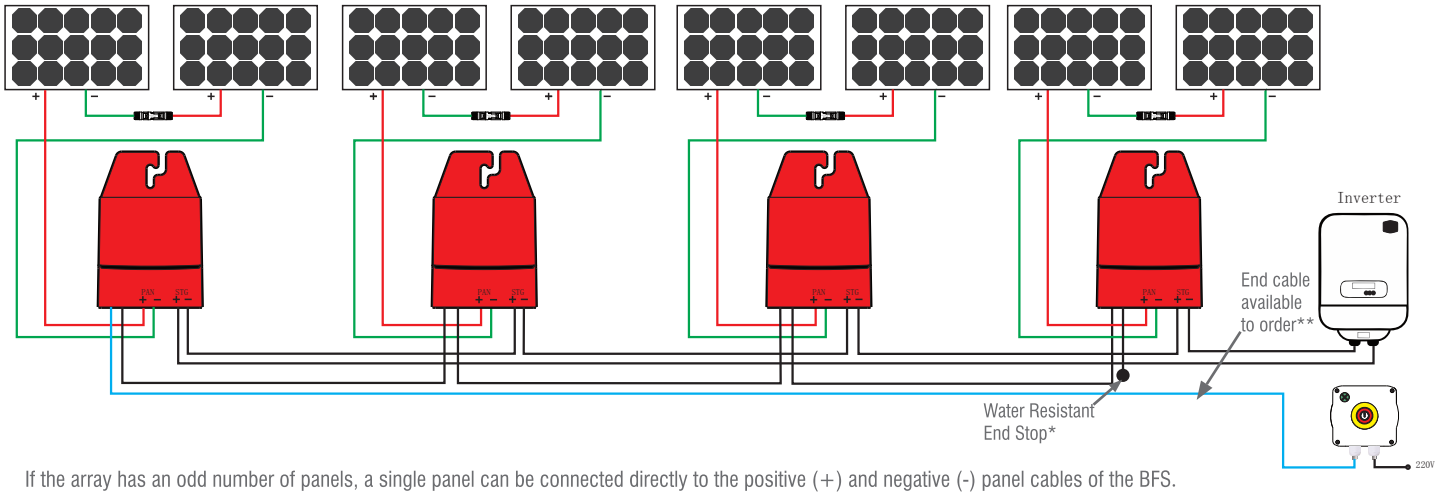
Do not remove wire links connected within the BFS-ESW11. Verify screw tightness in case of loosening in transit.

Connect the Communication SuperSeal 2-pole socket (female) to the BFS plug (male).

Warning – When the PV array is exposed to light, it supplies a DC voltage to this equipment. Connect and disconnect DC input and DC output circuits individually. Do not turn ON mains voltage until installation of BFS-ESW11 is completed and verified.

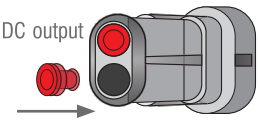
MULTIPLE INSTALLATIONS

One BFS (BFS-11 / BFS-12) will control two solar panels and by series connection of the BFS, multiple solar panel pairs can be connected to form a greater capacity system. The diagram below illustrates a typical example of a BFS protected installation using eight solar panels and four BFS-11/ BFS- 21



If the array has an odd number of panels, a single panel can be connected directly to the positive (+) and negative (-) panel cables of the BFS.
Also, the ZJBENY BFS system allows for multi-level/multi-zone installation through the use of an Emergency Switch Enclosure (BFS-ESW11 plus BFS-AWS1) connected in series with the initial Emergency Rapid Shutdown Switch's power supply Positive (+) wire 24VDC.

* Water resistant end stop - Insert the two red sealing plugs in to the Communication Superseal plug (supplied) and connect to the DC output connector of the last BFS (BFS-11/BFS - 12) in the series installation. If only a single BFS (BFS-11/BFS-12) is used then this part is still used to seal the DC output connector.



** A 1.8m flying lead terminated at one end with a female communication connector is available to order under part number EFS-CCABLE.

OPERATION

Upon correct mounting and connection of the BFS to the solar panels and the Emergency Shutdown Switch; and the turning ON of the mains supply, the BFS will be operational.

1. Manual Shutdown

   Upon the user operating the red push button switch located in the Emergency Switch Enclosure the BFS performs a Rapid Shutdown, disabling the PV array output.

2. AC Supply Cut-Off Shutdown

   Should there be a necessity by the emergency services for local or area utility grid shutdown, disconnection of the external AC supply, by whatever means, will cause the BFS to perform a Rapid Shutdown disabling the PV array output.

3. Automatic Emergency Shutdown

   a) Should the BFS-11onboard temperature sensor detect a temperature in excess of 85°C then the BFS will instigate an Automatic Rapid Shutdown thereby disabling the PV module's output. Should the detected temperature then drop back to below 85°C, the BFS will re-engage the PV module's output.

   b) In the event that the temperature sensor exceeds 92°C then the BFS-11will only re-engage the solar panels by a manual reset done via the Emergency Shutdown Switch (refer to point 4a below).

   c) With BFS-12, should the onboard temperature sensor detect an elevated temperature in excess of 92°C then, like point (a), the BFS-12 will ins tigate an Automatic Rapid Shutdown thereby disabling the PV string output. Operation will only be recommenced by a manual reset done via the Emergency Shutdown Switch （refer to point 4b below).

4. Reset

   a) On the occurrence of operation 1b (above) where the temperature sensor exceeds 92°C, once the area is deemed safe, the BFS-11 is reset by operating the Emergency Shutdown Switch and then releasing this switch.

   b) Upon occurrence of operation 1c (above), the installation and BFS-12 units must be checked by a competent person. Once the area is deemed safe then the BFS is reset by replacement of the appropriate fuse within the BFS-ESW21/BFS-ESW21-K and then operating the Emergency Shutdown Switch and then releasing this switch.

i The Emergency Shutdown Switch is a typical "one push" large red emergency push button which requires an anti-clockwise twist to release.

n The BFS-ESW11 and BFS-ESW11-K includes an LED indicator which when used with BFS-11 signifies 24VDC power (ON) or power loss (OFF). The LED is not a status indicator as referred to in UL 1741 and does not indicate isolation of the PV field.

n The BFS-ESW21 and BFS–ESW21–K includes an LED indicator which when used with BFS–12 signifies 24VDC power (ON), or power loss or trip (OFF). The LED is not a status indicator as referred to in UL 1741 and does not indicate isolation of the PV field.

TECHNICAL SPECIFICATION

	BFS-11/BFS-12
Emergency Shutdown Cable	2x1mm² cable + Communication SuperSeal 2-pole plug/connector (male/female)
DC Power Supply*	24VDC suitable for up to 30 BFS units (60 panels)
Maximum System Input Power	1200W(600W per panel)
Maximum System Input Voltage	120V(60V per panel)
Maximum System Input Current	12A
Maximum Isolation Voltage	1500V
Input Protection	Over voltage & transient voltage supression
Maximum System Output Current	12A (99.5% efficiency)
Breakdown Voltage	1500VAC for 1 minute
Maximum System Output Voltage	120V(60V per panel)
Output Protection	Over voltage, over current & transient voltage suppression
Max. Input Short Circuit Current	12A

Operating Temperature	–30°C to +95°C
Ambient Operating Temperature	–30°C to +55°C
IP Class Protection	>IP68 (NEMA 4X)
PV Casing	Flame retardant ABS - UL94-V0
Weight (without cables)	890g
Panel Cable Length	155mm
String & Signal Cable Length	1800mm
Standard Compliance	EN 61000, EN 61646, EN 61215, IEC 62716 draft C (NH_3 resistant), UL 1741
PV Connectors	Multi contact MC4

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Power Supply	BFS-ESW11/21(-K)	BFS-ESW12/22(-K)
Rated Input Voltage	90-264VAC	
Rated Input Current (at I_0 nom)	200mA (V_i 115VAC) / 135mA (V_i 230VAC)	
Rated Input Frequency	47-63Hz	
Rated Output Voltage	24VDC	
Rated Output Current	630mA	1000mA
Rated Output Power	15.2W	24W
Power Supply Connector Wiring	0.75 mm^2 / AWG 18	
Power Supply Torque	0.5 Nm / 4.5 lbin	
DIN Terminal Connector Wiring	0.5 - 4 mm^2 / AWG 26 - 10 (Note: BFS uses communication connector 2x1mm^2)	
DIN Terminal Torque	0.5 - 0.8 Nm / 4.5 - 7 lbin	
Ambient Operating Temperature	−30 °C to +40 °C	

* BFS-ESW11/12、BFS-ESW11/12-K Rapid Shutdown Switch can be upgraded to suit larger installations.

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Panel (pair) voltage is 0V	No mains supply (LED OFF)	Check area utility operational
		Check mains ON
	BFS-ESW11/12 power supply failure (LED OFF)	Check mains voltage between L & N marked terminals
		Check 24VDC between + & - marked terminals
	BFS-ESW11/12 switch activated	Turn red actuator anti-clockwise to release button
	No BFS-ESW11/12 switch output (LED OFF)	Check 24VDC between switch out terminal & PSU – marked terminal
	Broken cable (LED OFF)	Check 24VDC between terminals of remote communication SuperSeal connector (pin 1+24VDC\pin 2 0VDC)
	PV array not connected	Check all PV to BFS-11/BFS-12 input connections
	Incorrect BFS-11/BFS-12 polarity connection	Check PV array Positive (+) goes to BFS-1/BFS-2 Positive (+) and PV array Negative (-) goes to BFS-1/BFS-2 Negative (-)
	No BFS-11/BFS-12 output	Replace BFS-11/BFS-12
PV Inverter input 0V	No DC isolator (if fitted) input	Check BFS-11/BFS-12 output connections
		Check DC inputs to isolator
	DC Isolator (if fitted) OFF	Turn DC Isolator ON
String voltage too low	Incorrect BFS-11/BFS-12 polarity connection	Check all PV array Positive (+) go to BFS-11/BFS-12 Positive (+) and PV array Negative (-) go to BFS-11/BFS-12 Negative (-)

In the occurrence of a fire recommend that all elements of the BFS Rapid Shutdown system be assessed for operational suitability by a competent person prior to re-energising.