IRIS 500

APPLICATION MANUAL

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GENERAL

FLAME SAFEGUARD CONTROL

The IRIS Solid State Flame Safeguard Control offers maximum flexibility in application together with the reliability and stability expected of industrial safety equipment. The system will detect all types of flames in various fired equipment. Both ultraviolet and infrared type viewing heads are available. The system is fail-safe and continuously self-checking. In the ultraviolet viewing head the self-checking characteristics are implemented by using a shutter in the viewing heads that block the flame light path once each second. In the infrared viewing heads an electronic self-checking method is employed. If any component in the system from the viewing head to the flame relay is damaged or becomes defective the flame relay is de-energised, the alarm is sounded and fuel valves will be de-energised. The checking function does not interfere with the ability to detect a flame out. If the shutter should fail either open or closed the flame relay will be de-energised. The flame safeguard control sensitivity is continuously adjustable over a 136 to 1 ratio by means of two externally selectable 25-turn potentiometers for dual fuel or dual viewing head applications.

The contacts of the flame relay and the self-checking monitor relay are arranged in series to create two sets of changeover contacts. One set is designated for the safety circuit and has a one AMP fuse, with both the flame on and off contacts, providing a safe start check circuit The other set of contacts can be used for auxiliary functions such as indicating lights or alarms. The digital integrated circuits used are all standard burned-in CMOS "B" types. Flame out response time is adjustable in one-second increments from 1 to 6 seconds. An analogue meter is provided for an indication of flame intensity, while LEDS indicate when the two relays are energised. The system works on 24 VDC, 115 VAC or 230 VAC, field selectable.

ULTRAVIOLET VIEWING HEAD

The ultraviolet viewing head is recommended for gas and oil flames. It consists of a gas discharge type sensor with a spectral response only in the UV region, approximately 185 to 300 nanometers with a peak response at 200 nanometers. The highest UV intensity occurs near the flame root (first 30% of the flame) but this zone of higher UV intensity does not overlap the same zones of adjacent or opposing burners so that, with proper sighting, discrimination is predictable.

INFRARED VIEWING HEAD IRGS

The IRGS viewing head is specifically designed for the detection of oil and gas flames.

The operation of the IRGS is identical to the IR head, the exception being the germanium photodiode flame sensor, which operates, in the spectral range 750 nm to 1900 nm.

As with the IR head**,** good discrimination is achieved by an automatic gain control and a four Position high pass filter switch.

The IRGS has been specifically designed for operation on multi burner oil and gas burner applications with oil and gas being fired individually or together.

INFRARED VIEWING HEAD IR

The infrared viewing head is recommended for pulverised coal and oil flames. The IR viewing head uses an extended range, 200 to 1200 nanometers, silicon photodiode that is operated in the photovoltaic mode. The IR system takes advantage of the fact that all flames pulsate within two bands of the visible and near infrared spectral regions. This device incorporates an automatic gain control that operates on the brightness of the flame signal. This automatic gain control action is provided to overcome the problems associated with monitoring pulverised coal flames, which vary in brightness from low to high firing rates in addition to variations caused by ash and inconsistent fuel flow.

The flame signal, after this first stage of amplification is AC coupled to the next stage. This AC component of the signal is flame flicker, which covers a range from zero to over 1000Hz. The IRIS infrared viewing head accomplishes this by incorporating a variable high pass filter stage after the second stage of amplification. This variable filter has four positions that can be switched at the viewing head to optimise the discrimination ratio between flame ON and flame OFF.

TWO COLOUR VIEWING HEAD IRX2

The IRX2 viewing head is recommended for pulverised coal, oil, hydrogen sulphide and other difficult waste fuel streams where ultraviolet light is absorbed. The IRIS IRX2 employs a new

concept in infrared flame detection by utilizing a solid-state infrared "two-color" sensor in conjunction with electronic circuitry that takes advantage of the high frequency-flicker characteristics of flames. The "two-color" sensor is composed of a unique "see-through" silicon photovoltaic front element and a lead sulphide photoconductor back element. The silicon element covers the spectral range from 350 nanometers to 1100 nanometers and the lead sulphide detector covers the range from where the silicon elements begin to roll-off, 1100 nanometers to 3000 nanometers. The signals from both sensors, after amplification, are added or mixed resulting in a very wide spectral range, which covers the entire visual range well into the infrared longer wavelengths. This new flame monitor is especially useful on those difficult applications, such as black liquor recovery units and limekilns in the pulp and paper industry.

SPECIFICATIONS

M500 FLAME SAFEGUARD CONTROL

DESCRIPTION	Includes:(1) M502 Mother Board, (1) A503 Analog Board, (1) R-518-09 Sub-base and (1) R-518-10 Cover. Detector-- Select UV, IR or IRX2
FLAME DROP-OUT TIME – DIGITAL BOARD	Adjustable in one second increments from 1 to 6 seconds via dip switches, (for settings Figure 7 page 23)
FLAME DROP-OUT TIME – ANALOGUE BOARD	Pre-set at 2 seconds, adjustable 1-6 seconds via dip switches, (for settings see Figure 7 page 23)
SENSITIVITY SELECTION	Remote sensitivity selection: External switch can be connected to select the setting of either sensitivity control, R9 or R 10 for auto switching on dual fuel application.
SENSITIVITY ADJUSTMENT	Two potentiometers labelled R9 and R10 on plug-in analogue board. Twenty-five turns each, set independently. Range 136:1
AMBIENT TEMPERATURE	71ºC maximum
ELECTRICAL RATINGS	230 VAC or 115 VAC + 15%-20%, 50 -60 HZ, 24 VAC + 20%-20%. Power consumption is 30VA which includes viewing head, flame safeguard control and optional digital board
OVERALL DIMENSIONS	Length 224 mm Width 175 mm Height 152 mm
WEIGHT	1.70 kg with Analogue Board 1.85 kg with Digital Board
OUTPUTS	Analogue flame relay: 1 SPDT safety contact set with 1 AMP fuse 240 VAC 1SPDT contact rated 2 AMPS 240 VAC. Digital flame relay: 2 SPST rated 2 AMPS 240 VAC. 1 normally open contact and 1 normally closed contact. Analogue flame signal: 4 to 20 mA current output for remote meter or chart recorder. Maximum resistance, 360 ohms.
APPROVALS	B.P. Sunbury - Test & Evaluation Australian gas Association (AGA) Report No. 4993
DIGITAL BOARD (OPTIONAL)	Plug in diagnostic and "set-up" board is composed of a four- digit LED display and two four-digit adjustable set point switches, one for the "flame-on" threshold and one for the "flame -off" threshold. Highly recommended where discrimination is a problem.

VIEWING HEADS S505, S506, S509, S511

IRX2 UNIVERSAL DETECTOR	S509, "two-colour" high frequency flicker infrared viewing head, with four position selectable fitter and two 25-turn adjustable gain controls, one for the silicon photodiode cell and one for the lead sulphide cell. Monitors radiation from all fuels, 340 to 3000 nanometers.
IR INFRARED DETECTOR	S505, high frequency flicker infrared viewing head, with four position selectable filter and 25-turn adjustable gain control for the silicon photodiode cell. Monitors radiation from oil and pulverised coal, 340 to 1100 nanometers.
IRGS INFRARED DETECTOR	S511 high frequency flicker infrared viewing head, with four position selectable filter and 25-turn adjustable gain control. Monitors radiation from gas and oil flames, 750 to 1900 nanometers.
ULTRAVIOLET DETECTOR	S506 ultraviolet viewing head. Monitors radiation from gas and oil fuels, 185 to 300 nanometers.
AMBIENT OPERATING TEMPERATURE RATINGS	Normal operation to 71^0C, 160^0F case temperature. Maximum 100^0C, 212^0F.
ELECTRICAL RATINGS	See specifications M500 Flame Safeguard Control, Page 5.
OPTICAL	IRX2, S509, angle of view 2.7 degrees. Material-Special IR lens with transmittance from 209 to 3600 nanometers IR, S505, IRGS, S511 angle of view 2.7 degrees. Material-IR lens standard optical glass with transmittance from 300 to 2600 nanometers Ultraviolet, S506, angle of view 2.7 degrees. Material is fused silica with transmittance from 170 to 2200 nanometers
SELF CHECK FREQUENCY	Circuits are interrupted for a period of 200 milliseconds every second
HOUSING	Meets IP 65 standards watertight and dust tight, for indoor/outdoor installations. Construction is aluminium. One quarter turn quick disconnect from mounting flange
WIRING CONNECTIONS	Five-pin quick disconnect connector at rear of housing meets IP 65 standards.
PURGE AIR FLOW REQUIREMENTS	One cubic foot per minute
MOUNTING	Mounting flange has a one inch B.S.P. female thread for mounting onto sight pipe and a ½" B.S.P. thread for purge air supply connection. Viewing head is connected to mounting flange by four screws:
CABLE Standard – **Armoured -**	Cable composed of five conductors, 1mm² with overall screen and PVC outer covering. IRIS Part No. C-516. As above but with steel wire armour protection and PVC outer covering. IRIS Part No. C-516-S
OVERALL DIMENSIONS	205mm x 103mm including connector
WEIGHT	850 grams

PARTS LIST

PART NO.	DESCRIPTION
M502	MOTHER BOARD BASE AND COVER
A503	ANALOG BOARD WITH METER
D504	DIGITAL BOARD
S505	IR VIEWING HEAD
S506	UV VIEWING HEAD
S509	IRX2 VIEWING HEAD
S511	IRGS VIEWING HEAD
R-518-01	IRGS MAIN ASSEMBLY (PC BOARD WITH LOOSE WIRES)
R-518-02	ULTRAVIOLET MAIN ASSEMBLY (PC BOARD WITH LOOSE WIRES)
R-518-03	IR MAIN ASSEMBLY (PC BOARD WITH LOOSE WIRES)
R-518-04	IRX2 MAIN ASSEMBLY (PC BOARD WITH LOOSE WIRES)
R-518-05	MOTHER BOARD ONLY- NO BASE COVER OR CARD GUIDES
R-51 8-06	AMPHENOL-TUCHEL PLUG
R-51 8-07	AMPHENOL-TUCHEL RECEPTACLE
R-518-09	BASE ONLY
R-518-10	COVER ONLY
R-518-11	SHUTTER ASSEMBLY
R-518-12	1" HEAT INSULATOR
M-701-1	SWIVEL MOUNT – 1"
C516	DETECTOR CABLE - PVC
C516-S	DETECTOR CABLE – STEEL WIRE ARMOURED
M-702-1	UNION WITH QUARTZ WINDOW
PM-324	PANEL METER (0-25 mA)
R259	UV TUBE
109	400 mA FUSE
111	1Amp FUSE
185/173	IR LENS ASSEMBLY
185/174	IRX2 LENS ASSEMBLY
1851175	UV LENS ASSEMBLY

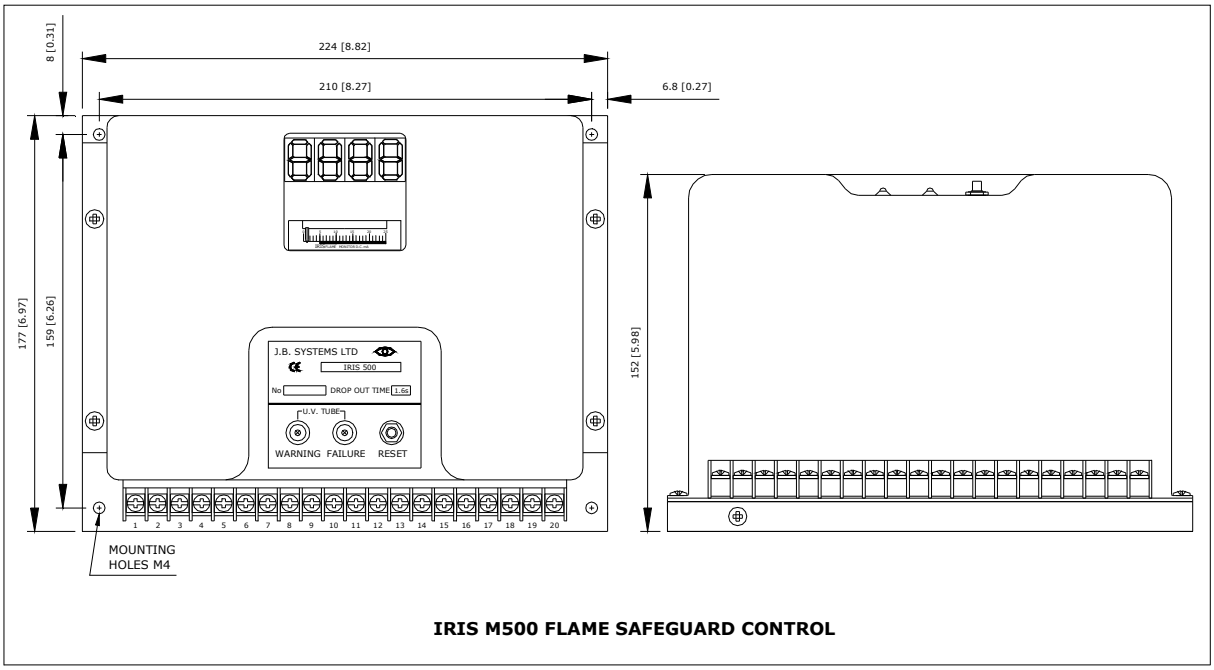


Figure 1

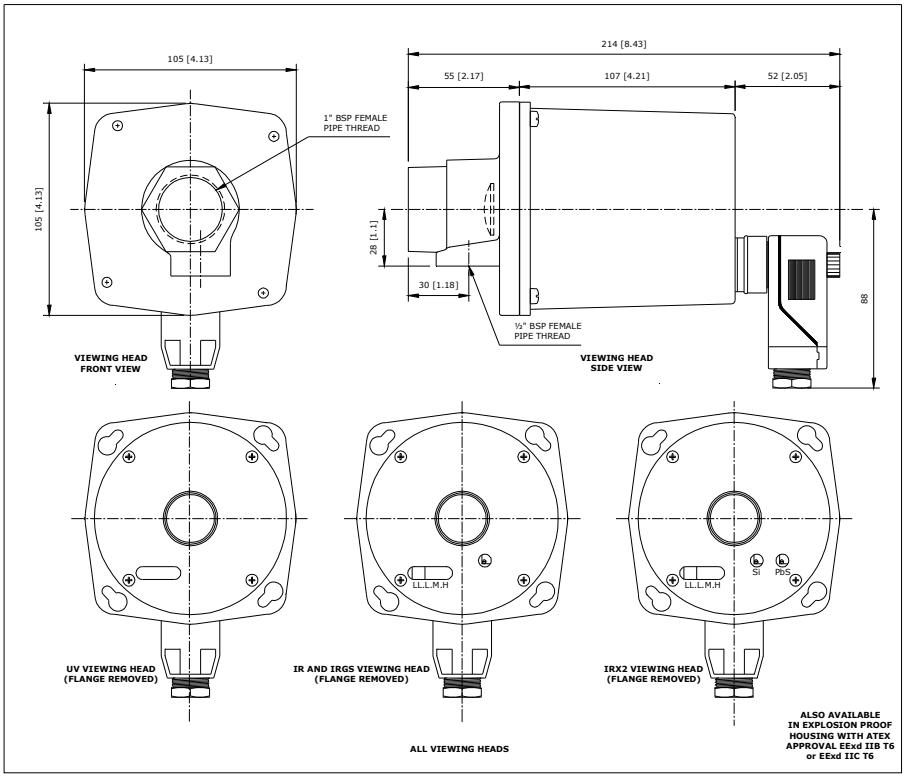
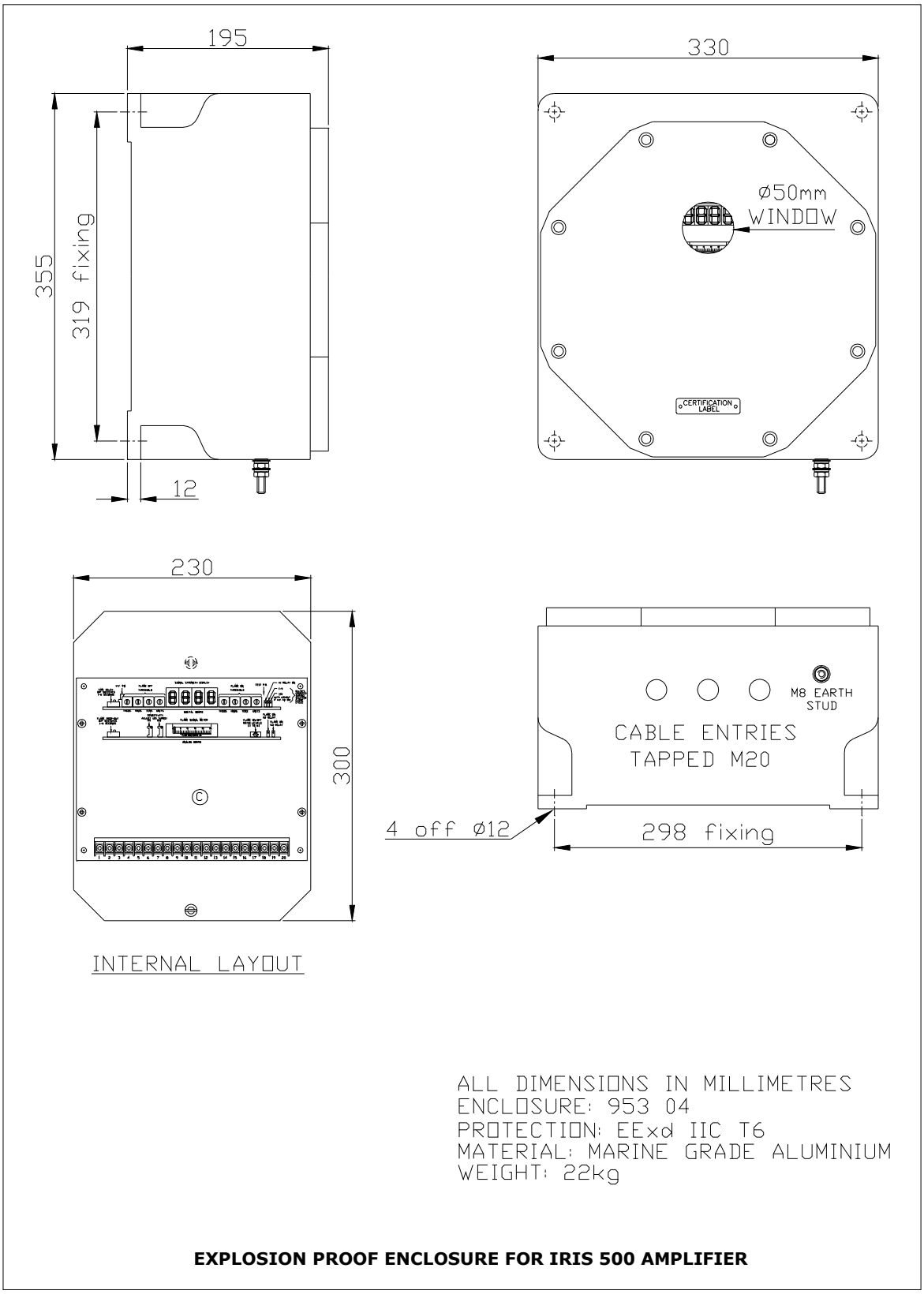


Figure 2

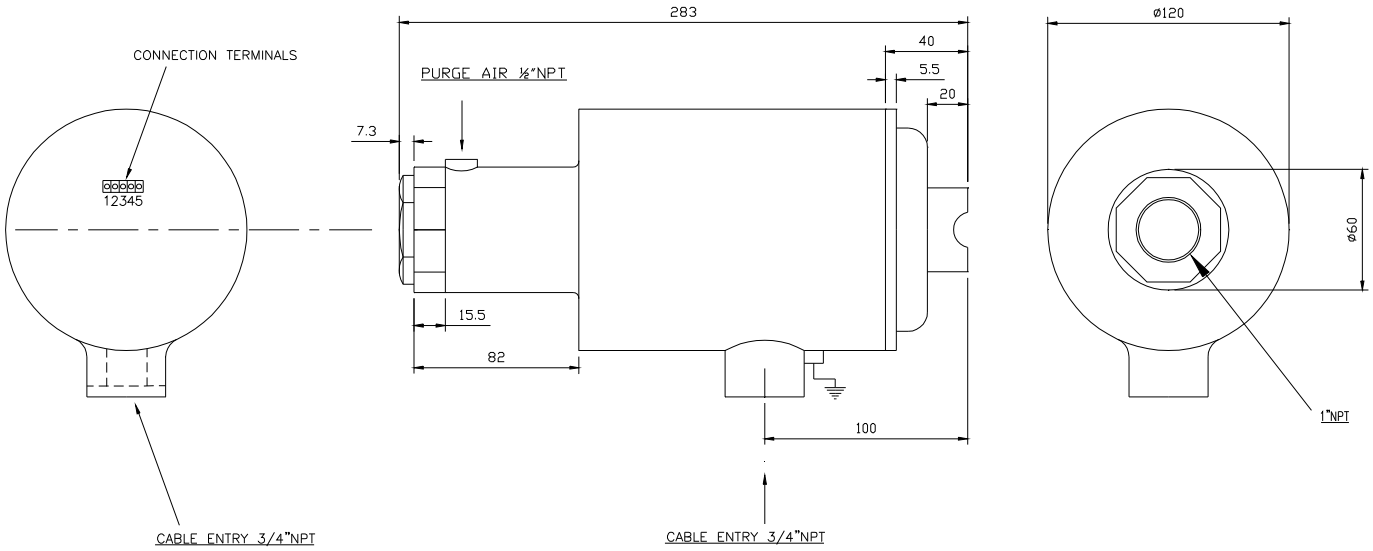


EXPLOSION PROOF ENCLOSURE FOR IRIS 500 AMPLIFIER

Figure 3

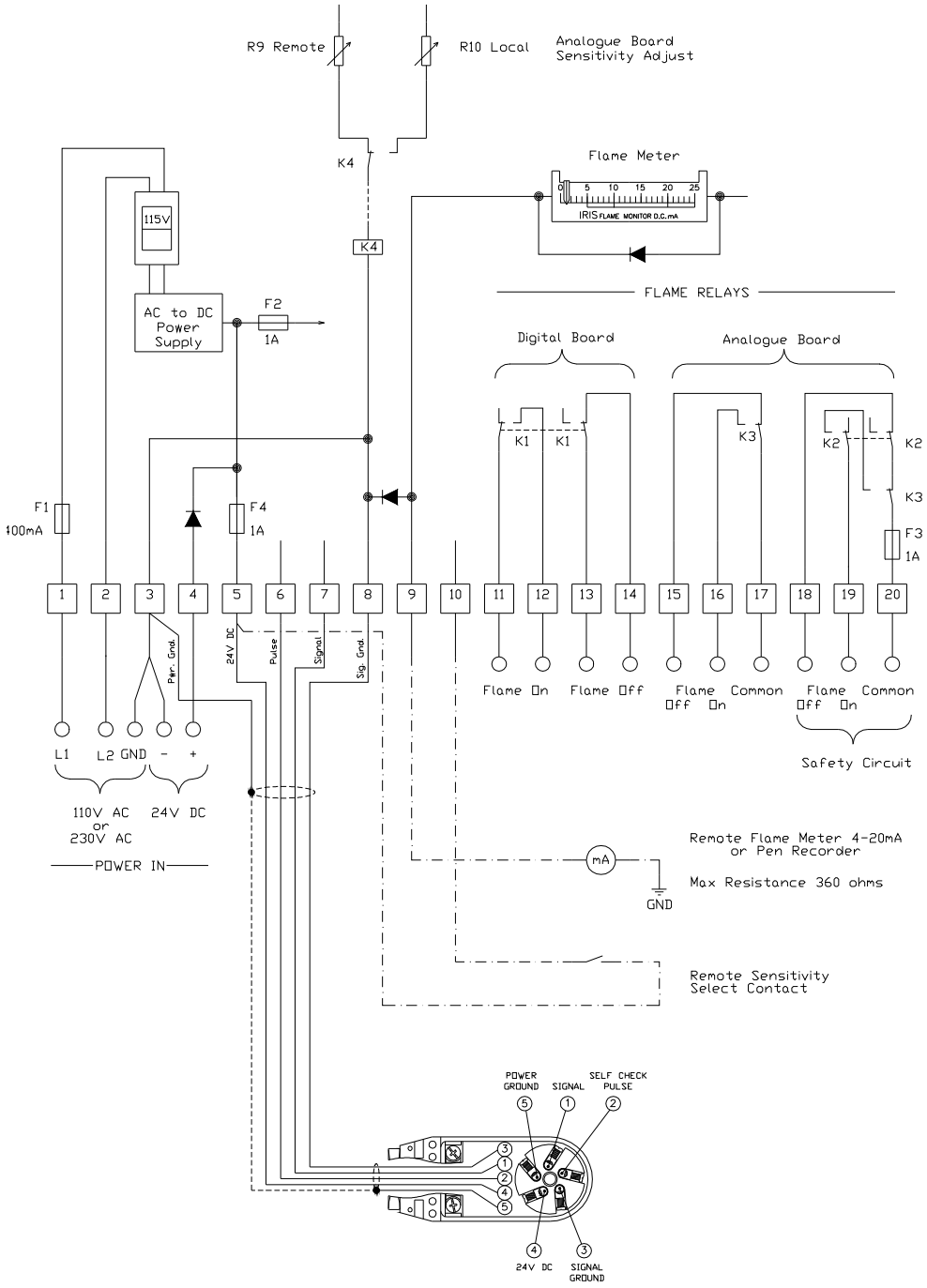
TERMINATIONS;

1 – SIGNAL
2 – SELF CHECK PULSE
3 – SIGNAL GROUND
4 – 24V DC
5 – POWER GROUND



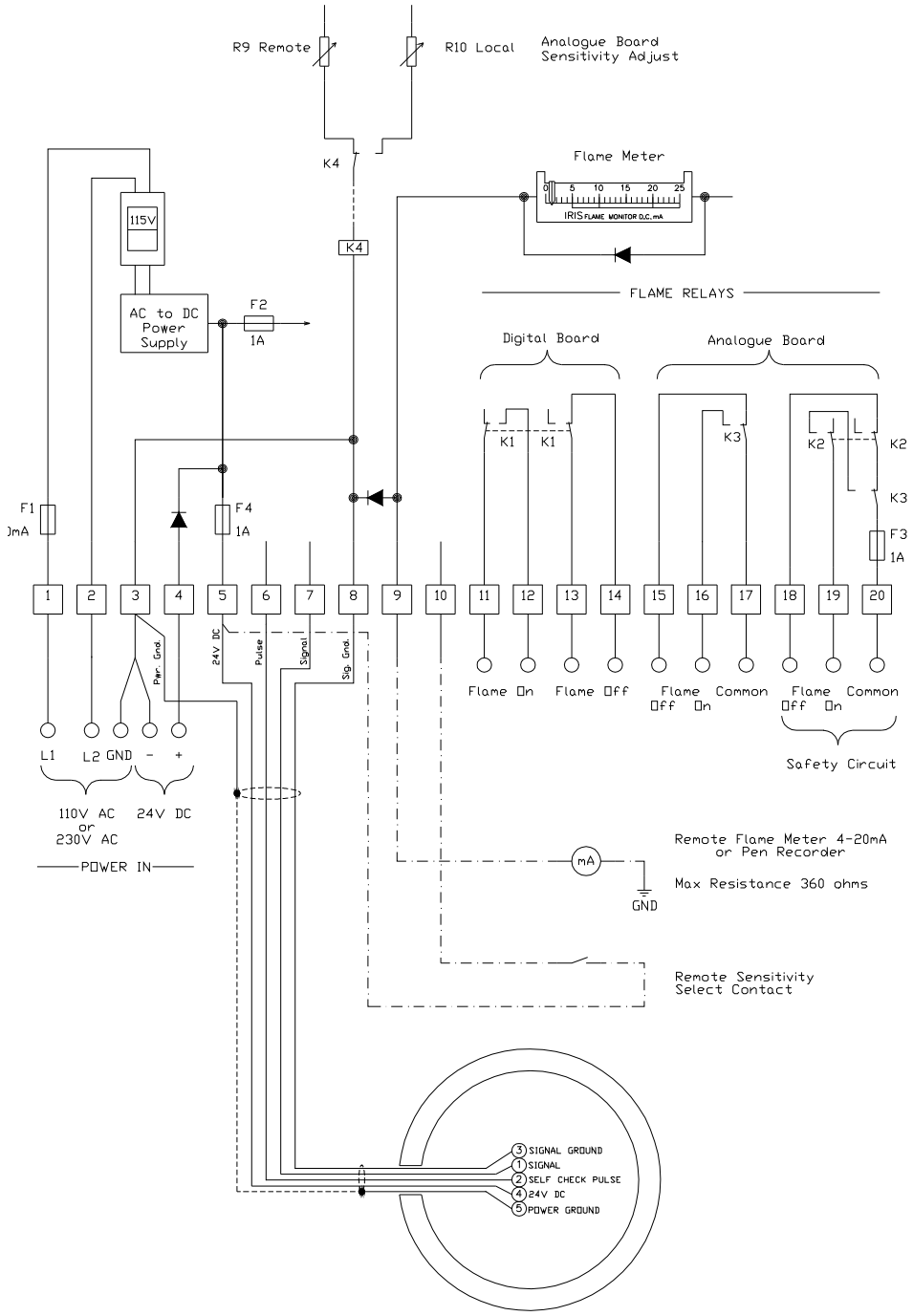
NOTES:

ALL DIMENSIONS IN MILLIMETRES
WEIGHT : 2.5 Kgs.
CERTIFICATION : EExd II C T6 CESI/CENELEC



Non-Hazardous area connector shown with cover removed - wiring side

WIRING SCHEMATIC



EExd IIB and EExd IIC Viewing Head Connection

WIRING SCHEMATIC

ORDERING INFORMATION

COMPLETE DEVICES

When ordering these components, please specify model number for each item desired, including optional devices by part number

PARTS

Order parts by exact part number. See page 4 for complete parts list

If PVC cable is required, this can be cut to length and plugs fitted if required.

PLANNING THE INSTALLATION

Correct flame viewing head application provides for maximum safety and assures reliable flame safeguard operation. Refer to the burner manufacturer's instruction as well as those included here. Follow all instructions carefully.

VIEWING HEAD LOCATION

Before beginning the actual installation, determine the best location for mounting the viewing head based upon these factors:

PRESSURE

If the fired unit is pressurised, the union with quartz lens, Pt. No. M-702-1, must be used to isolate the viewing head. Place purge air connection between the union and the fired unit.

TEMPERATURE

Install the viewing head where the surrounding temperature will remain within the specified ambient operating temperature ratings. If the temperature at the viewing head exceeds temperature ratings specified, the introduction of cooling-purging air will be required, or alternatively fit heat insulator R518-12.

VIBRATION

Do not install the viewing head where it could be subject to vibration. Provide an anti-vibration mount if excessive vibrations are present.

CLEARANCE

Make sure there will be enough room to remove the detector for servicing. See Figure 2.

RADIATION SOURCE OTHER THAN FLAME

Following are examples of radiation sources, other than flame, which can be sensed by the viewing head and actuate the detection system.

INFRARED VIEWING HEADS

The detector may respond to a radiant surface at a temperature above 1000^0C (1832^0F) if the following conditions are present

a. The detector filter switch is set at LOW and the surface represents a significant percentage of the detector's field of view.

b. Flicker is present

c. If the temperature of a radiant surface causes the flame relay in the flame safeguard control to pull in, re-aim the sight pipe to avoid the hot refractory and/or change the filter switch to a higher position.

ULTRAVIOLET VIEWING HEAD

a Ignition spark
b. Welding arcs
c. Radiographic x-ray machines

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SINGLE BURNER REQUIREMENTS

The detector must have an unobstructed view of the flame envelope it is supervising under all firing conditions.

SIGHTING ANGLE

The first 30 percent of a flame, the root, radiates the most intense ultraviolet and high frequency infrared energy. Sighting along the flame rather than across it permits the detector to view a greater depth of the flame root, obtaining better response. See Figure 4.

In most installations, the viewing head will need to respond to the igniter (pilot) flame singularly, then to the igniter and main burner flame simultaneously, and finally to the main burner flame alone.

MULTI-BURNER – MULTI-FUEL REQUIREMENTS

Multi-burner installations require discrimination, meaning that each viewing head responds only to the flame envelope produced by the burner it is supervising. Not every viewing head can be positioned so its line of sight does not intercept flames from other burners. This situation occurs in multi-level opposed-fired furnaces where the burners face each other. In such cases the sighting angle is set up as described above, with the viewing head sighting along the flame directly into the radiation intense flame root. If an opposing or adjacent burner flame falls in the line of sight of this viewing head, it may be tuned out by decreasing the sensitivity of the flame safeguard control so that it does not respond to the low frequency zone of the second flame. See Figure 5.

When using an infrared viewing head and the sensitivity control on the analogue board is set at its minimum position counter-clockwise and flame discrimination cannot be achieved change the four position filter switch in the viewing head to the next highest position. This will reduce the low frequency flicker reaching the detector so that the sensitivity can be adjusted to effect flame discrimination. The four cut-off frequencies are 36, 71, 105, 186 HZ

Ultraviolet viewing heads supervising burners that use alternately more than one fuel may require a different sensitivity level for each fuel. Higher sensitivity is required to reliably sense heavy fuel oil than that required to sense natural gas or light fuel oil. Reliable flame sensing, and flame discrimination, may not be maintained without changing the sensitivity setting when fuels are changed. The Model 500 flame safeguard control includes two integral sensitivity adjustments that can be remotely selected, which when properly set, allows the monitoring of two fuels. See: Installation Instructions.

PARALLEL VIEWING HEADS

Parallel operation of viewing heads with one monitor board and amplifier is possible with this system. Two of the same type or a combination of viewing heads can be wired in parallel The self-checking characteristics are still operational because the shutters are driven together in unison. The flame signals will be additive possibly requiring a lower sensitivity setting.

Two infrared viewing heads can be connected in parallel to the same flame signal amplifier and still provide independent sensitivity adjustment. This capability is particularly useful for multi-burner, multi-fuel applications.

Shifting flame patterns, commonly encountered on burners with wide turndown ratios, may require parallel viewing heads to prove the flame at the highest and lowest firing rates. In this case, one viewing head supervises the pilot (interrupted) and both detectors supervise the main burner flame. During the main burner "run" period, either viewing head is capable of maintaining system operation.

In addition to assuring more reliable flame detection, parallel viewing heads facilitate maintenance during burner operation. A viewing head can be removed in turn without shutting down the supervised burner.

REDUNDANT FLAME DETECTION SYSTEM

Two viewing heads connected to two flame safeguard controls with their outputs wired in parallel comprise a redundant flame detection system. In addition to the features of parallel flame detectors, a redundant system decreases nuisance shutdowns and is therefore recom-mended for critical burner applications. Flame signal loss or flame simulating failure occurring in either control or viewing head; will cause an alarm only allowing corrective action to avert a shutdown.

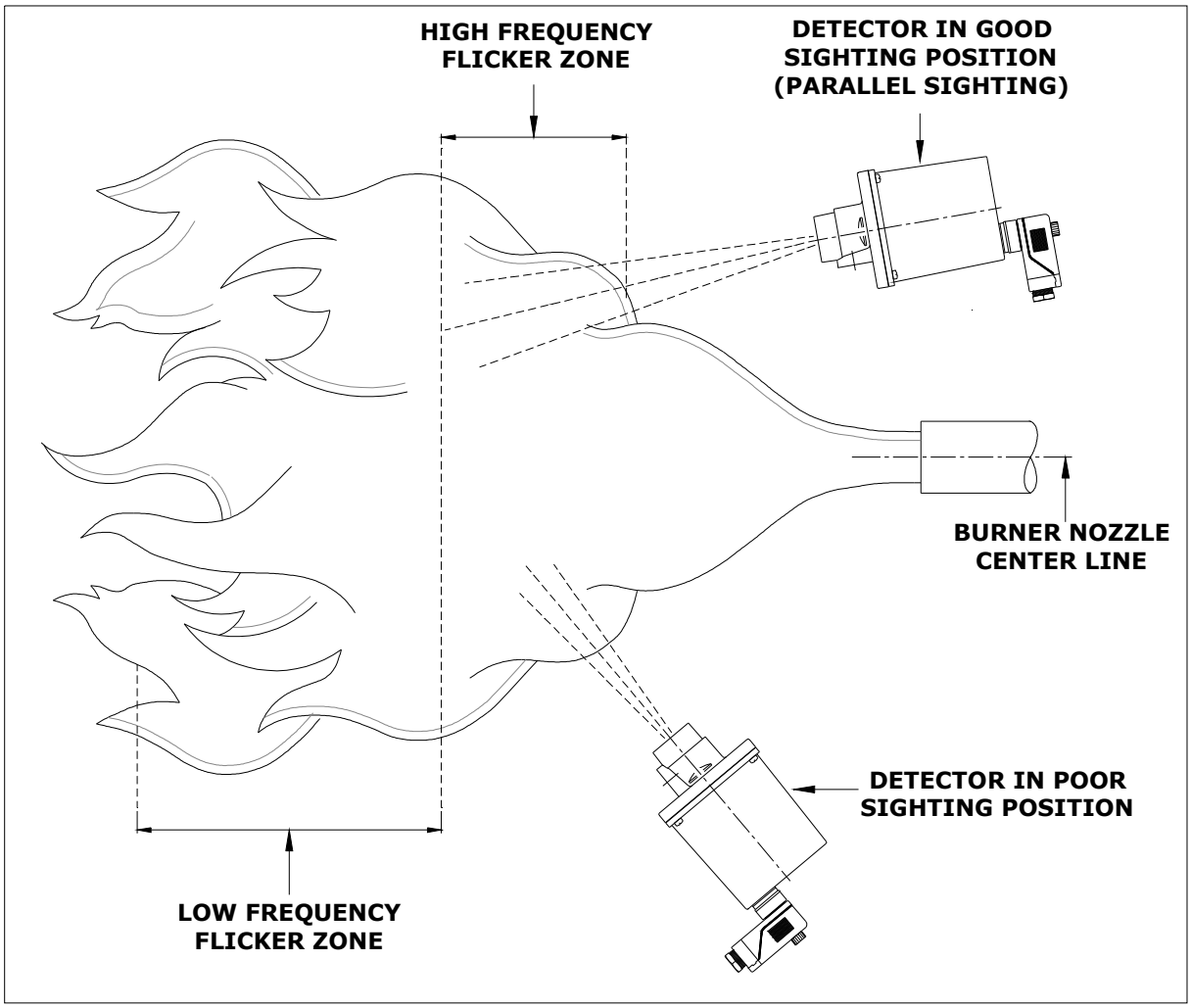

Figure 4

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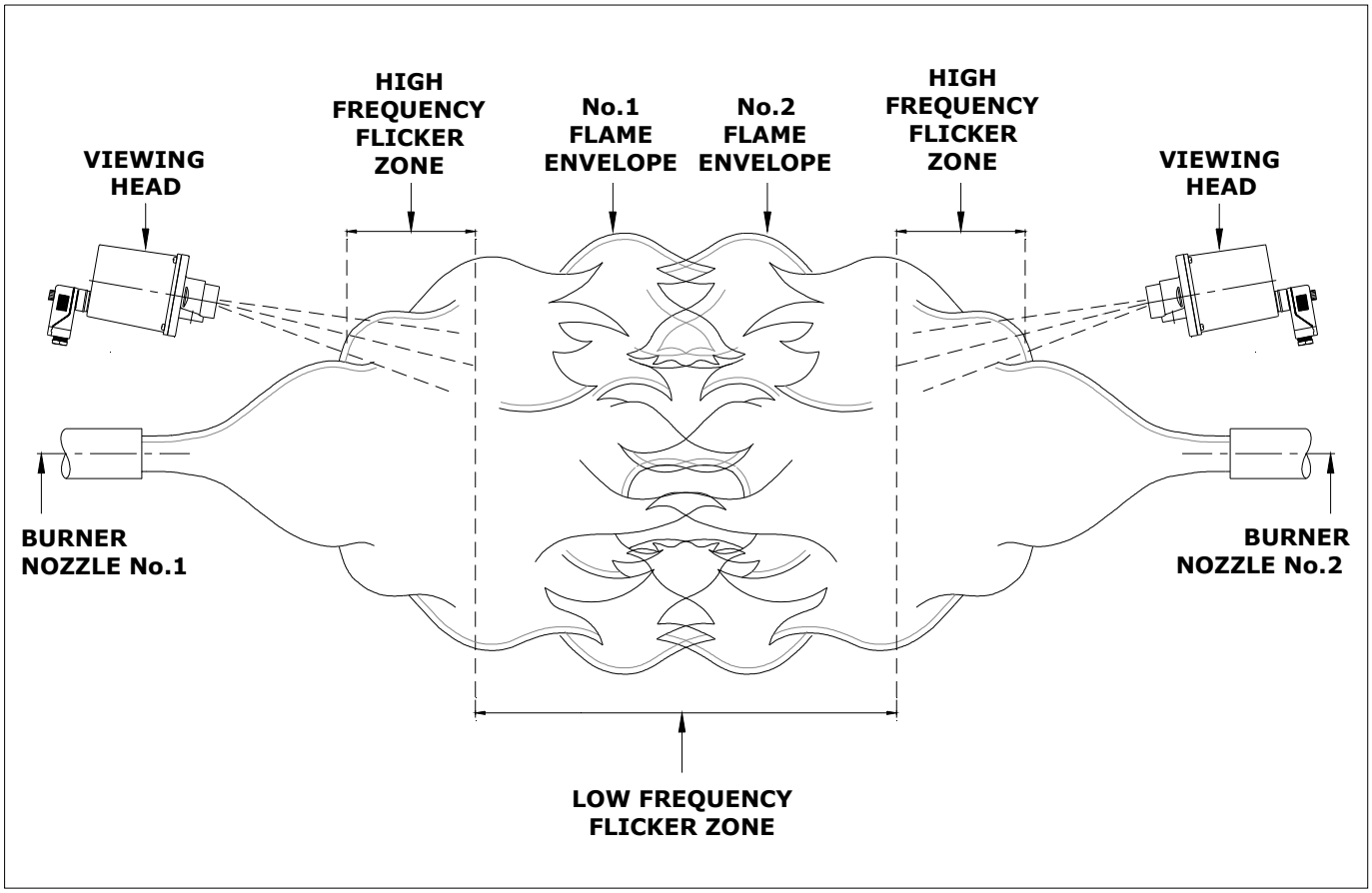
HIGH
FREQUENCY
FLICKER
ZONE
No.1
FLAME
ENVELOPE
No.2
FLAME
ENVELOPE
HIGH
FREQUENCY
FLICKER
ZONE
VIEWING
HEAD
VIEWING
HEAD
BURNER
NOZZLE No.1
BURNER
NOZZLE No.2
LOW FREQUENCY
FLICKER ZONE

Figure 5

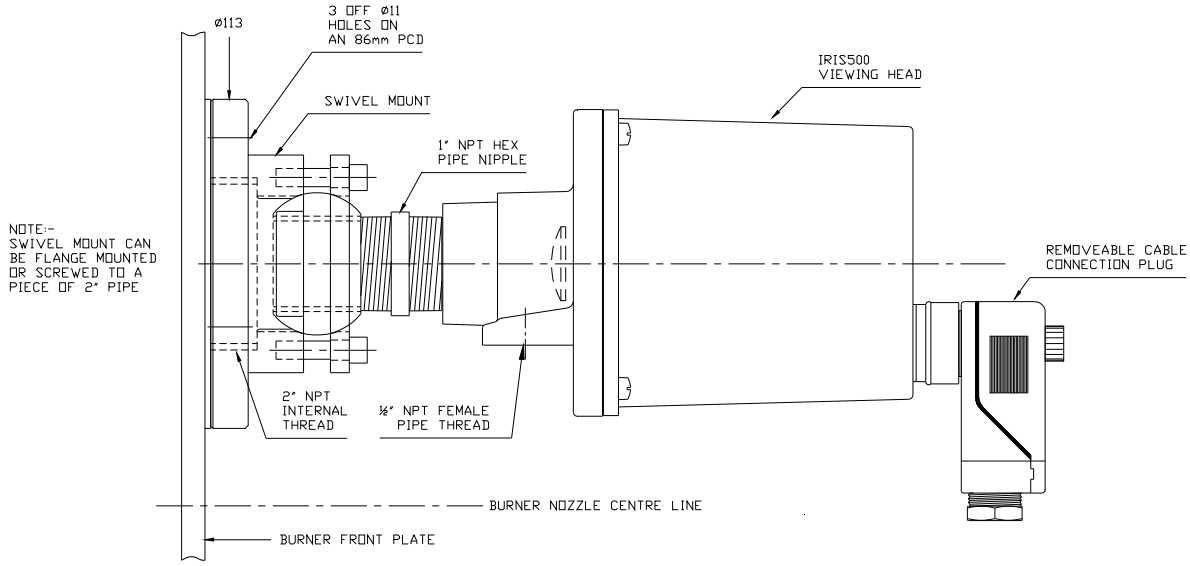

Figure 6A

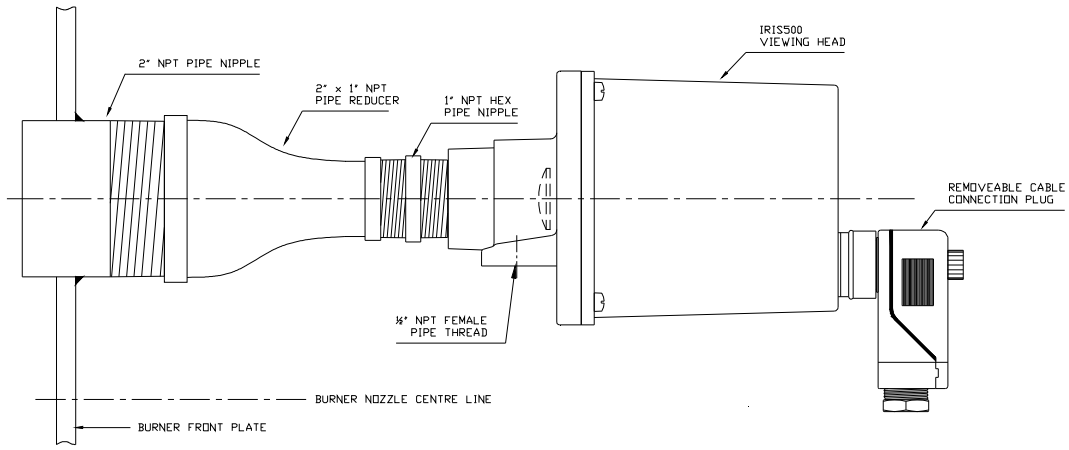

Figure 6B

INSTALLATION

CAUTION

- Installer must be a trained, experienced flame safeguard control serviceman.
- Disconnect power supply before beginning installation to prevent electric shock and equipment damage.
- All wiring must comply with applicable local electrical codes, ordinances, and regulations.
- The digital and analogue boards must never be unplugged from the motherboard whilst the unit is powered.
- The conduit fitting must be watertight to meet IP 65 standards. Use fitting supplied with viewing head.
- If an air supply is connected to the viewing head, its pressure must equal or exceed that required to seal off the head from the combustion chamber. See Figure 6.
- On multi-burner installations, each viewing head must respond only to the flame produced by the burner it is supervising.
- Do not connect more than two viewing heads in parallel to a single flame safeguard control.
- Perform all required adjustments and checkout tests after installation is complete.

INSTALLATION OF SIGHTING PIPE

SELECT THE PIPE

After you have determined the approximate location and sighting angle, select the sight pipe. A black iron pipe is recommended to provide reliable flame sensing. The viewing head is tapped for a one inch BSP threaded pipe. A larger pipe may be necessary to obtain proper performance. Any diameter sighting pipe larger than one inch will require a reducer coupling. See Figure 6. If a sight pipe longer than 36 inches is required, use a 2 inch diameter pipe with the reducer as close to the detector as possible.

NOTE: An IRIS M-701 -1 swivel mount is recommended to facilitate sighting the flame properly when sighting along the flame is not possible.

PREPARE THE MOUNTING HOLE

Cut a hole of the proper diameter for the sight pipe in the burner front or windbox at the selected location. The hole should be at least 2 inches in diameter to allow adjustment of the sighting angle. If register vanes interfere with the desired line of sight, trim the interfering vane(s) to assure an unobstructed view of the flame.

MOUNT THE SIGHT PIPE

Cut the pipe to the desired length. Thread one end of the pipe to fit the viewing head or required coupling. See Figure 6. Insert the other end of the pipe into the mounting hole, align the pipe to the desired sighting angle, and tack weld it in place to allow further sighting adjustments. Make sure the tack weld will support the weight of the detector when it is installed. If the flame signal is too small, reduce the length or increase the diameter of the pipe to increase the field of view of the detector. Once final position is determined weld sighting pipe in place.

INSTALLATION OF THE VIEWING HEAD

The viewing head screws directly onto a one-inch BSP threaded pipe. See Figure 6. Use a crescent wrench to tighten the head onto the sight pipe.

CONNECT THE AIR SUPPLY

Use a flexible air supply line that will allow repositioning of the sight pipe until the permanent detector position has been verified. Where the viewing head is mounted a continuous flow of air must be maintained to keep the head cool and the sight pipe clean. It is recommended that at least one CFM be provided for each viewing head.

WIRING

All wiring must comply with applicable electrical codes.

A five conductor cable 1 mm^2 or larger, with overall screen, is required for wiring between viewing head and the flame safeguard control.

IRIS multi-conductor scanner cable, Part No. C516 is recommended.

In general, the larger the wire size, the longer the cable can be. The principal limiting factor is the combined loop resistance of the cable plus the connection resistances with respect to the shutter drive circuit. The power for the shutter must be transmitted to the viewing head from the signal processor (motherboard), which involves two wires, (Shutter Drive and Signal Ground, terminals 6 and 8 on the processor). The loop resistance must not be greater than 10 ohms.

ADJUSTMENTS AND CHECK OUT

CAUTION

Prior to burner light off, be thoroughly knowledgeable with the burner/boiler manufacturer's instructions and the burner management sequence of operation.

FLAME SIGNAL READINGS AND SETUP PROCEDURES

Final setting of the viewing head may be determined by using the flame current meter on the analogue board, Part No. A503. The analogue board is the principal signal processor and has two sensitivity potentiometers for burner on and burner off flame relay actuation. Readings taken at the analogue board will facilitate installing the viewing head in the best sighting position by pinpointing the region of high intensity flicker and maximum brightness for a given flame**.**

Another and better method for establishing the final sighting position of the viewing head for difficult applications, such as waste fuel streams, is by using the optional digital board, Part No.D504. The digital readout is composed of a four-digit LED display and two four-digit set points switches, one for the flame on threshold and one for the flame off threshold. This processor counts the number of pulses transmitted from the viewing head each time the shutter opens. In addition to displaying the number, it will switch the digital output relay on if the number is equal to or greater than the selected on set point and will switch the output relay off if the number is equal to or less than the selected off set point.

The advantage of using the digital board for initial trials is that the four-digit number is an absolute indication, that is, it will represent a given flame signal as a number rather than an analogue meter reading, and will give repetitive readings that are accurate, and consistent. The digital display will accurately define the flame-out ratio with respect to the burner being monitored and the adjacent or opposite burner. Also, the digital display will accurately define the optimum high pass filter to use for a given sighting. The next page details a procedure for achieving good flame discrimination in difficult applications, made possible by using the digital board.

TYPICAL FUEL	VIEWING HEAD	DIGITAL COUNT
Natural gas:	UV/IRGS	300 - 500
Hydrogen sulphide:	IRX2	200 - 400
Light oil:	UV/IR/IRGS	1000 - 2500
Heavy oil:	UVIIR/IRGS	750 - 2000
Pulverised coal:	IR	1000 - 2000

THE DIGITAL BOARD - DISCRIMINATION ADJUSTMENTS

In some more difficult multi burner applications, discrimination between adjacent flames is sometimes difficult to achieve by using the analogue board only.

There is available a technique whereby the digital board controls the sensitivity of the analogue board - and thus the flame on signal derived at terminals 19 & 20 on the motherboard. The setting up procedure is as follows: -

1. On the motherboard, connect terminal 10 to 11 and 5 to 12. This means that the remote sensitivity potentiometer R9 on the analogue board is switched into circuit by the digital board.

2. ADJUST R10 (ANALOG BOARD) FULLY ANTICLOCKWISE

3. ADJUST R9 (ANALOG BOARD) FULLY CLOCKWISE

4. SET FLAME ON THRESHOLD (DIGITAL BOARD) TO 0050.

5. SET FLAME OFF THRESHOLD (DIGITAL BOARD) TO 0010.

6. SET UV SW (DIGITAL BOARD) TO OFF POSITION I.E TOWARDS THE TOP OF THE BOARD.

7. SET TIME DELAY SW (DIGITAL BOARD) TO 1 SEC.

8. SET TIME DELAY SW (ANALOG BOARD) TO REQUIRED DROP OUT TIME

9. SET FLAME ON/OFF RATIO LEVEL (ANALOG BOARD) TO 1.

10. SIGHT UP THE BURNER AND ADJUST SIGHTING POSITION TO GIVE THE OPTIMUM READING ON THE DIGITAL BOARD. (NOTE AVERAGE READING)

11. EXTINGUISH THE FLAME AND NOTE THE READING ON THE DIGITAL BOARD.

NOTE:

THE RATIO OF FLAME ON TO FLAME OFF SHOULD IDEALLY BE IN EXCESS OF 2:1.

THE SIGHTING POSITION OF THE VIEWING HEAD SHOULD NOW BE ADJUSTED TO GIVE NOT NECESSARILY THE HIGHEST READING WITH FLAME ON BUT THE HIGHEST RATIO OF FLAME ON/FLAME OFF.

FOR PURPOSES OF CLARIT'Y WE SHALL ASSUME A FLAME ON READING OF 400 AND A FLAME OFF READING OF 200.

12. ADJUST THE FLAME ON THRESHOLD (DIGITAL BOARD) TO 350.

13. ADJUST THE FLAME OFF THRESHOLD (DIGITAL BOARD) TO 250.

14. LIGHT UP THE BURNER AND CHECK THAT RELAY K1 LED (DIGITAL BOARD) COMES ON AND ALSO THAT RELAYS ~ AND K3 LED's (ANALOGUE BOARD) COME ON.

15. ADJUST R9 (ANALOG) UNTIL METER IS REGISTERING IN THE GREEN AREA APPROX 15mA

16. LIGHT UP AND SHUTDOWN SEVERAL TIMES TO ESTABLISH THE ACCURACY OF THE SETTINGS.

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SENSITIVITY, GAIN AND FLICKER ADJUSTMENTS

Verify the igniter and main burner flame envelops individually, if only one viewing head is used per burner. An (igniter) pilot turndown test must be done for all applications in which the detector must prove the pilot before the main fuel valve can open. This test proves that the smallest pilot flame which can hold in the flame relay is also capable of safely igniting the main burner. The test includes closing the main fuel valve to verify a safe main burner light-off. Verify that the viewing head discriminates between each individual burner flame. Ensure that maximum burner on to burner off signal ratio, is achieved throughout the entire turndown range of the unit.

SINGLE BURNER SYSTEM INSTRUCTIONS

INFRARED VIEWING HEADS

1. Disconnect the viewing head from the mounting flange.
2. Place the filter switch in the LOW (LL) position.
3. Turn both gain controls, in the viewing head, clockwise to maximum position. Turn the sensitivity potentiometer, R10 on the analogue board clockwise to maximum position.
4. Replace the viewing head on mounting flange.
5. Start the burner.
6. Read the flame signal in milliamps on the analogue board and/or counts on the digital board, if used. If the meter signal is in the red zone, or if the meter is pegged, readjust sensitivity potentiometer, R10 to bring the signal to the green zone of the meter.
7. Optimise the flame signal by adjusting the line of sight for maximum flame signal for both the igniter and the main burner flame. Be sure that the viewing head has an unobstructed view of both flames.

ULTRAVIOLET VIEWING HEADS

1. Turn the sensitivity potentiometer, R10 on the analogue board A503, clockwise to maximum position.
2. Start the burner.
3. Read the flame signal in milliamps on the analogue board and/or counts on the digital board, if used.
4. Optimise the flame signal by adjusting the line of sight for maximum flame signal. If the meter signal is in the red zone, or if the meter is pegged, readjust sensitivity pot R10 to bring the signal to the green zone of the meter.
5. Repeat Step 4 for both the igniter and the main burner flame.

MULTIBURNER SYSTEM INSTRUCTIONS

INFRARED VIEWING HEADS

Complete Steps 1 through 7 under "Single Burner Systems" above. Then with all burners in operation, select one burner and proceed as follows:

1. Note the digital/analogue flame signal readings. Remove the burner from service and note the flame signal readings
2. The flame relays should de-energise and flame signal readings should be zero. If not, adjust sensitivity pot. R10. until the flame relays drop out. If the background signal cannot be removed, then move the filter switch on the viewing head to the LOW (L) position.
3. Again, adjust the sensitivity pot to cause the flame relays to drop out See instructions for filters, Page 22.
4. Re-light the burner and note the flame signal readings. The difference in readings for burner on/off represents the degree of flame discrimination.
5. Repeat the start-up and shut down procedures until the optimum setting has been achieved. If the sensitivity control (R10) is reduced to minimum position and filter

switch has been moved to high position and flame discrimination still cannot be achieved, reduce the gain of the viewing head by moving the potentiometers counter-clockwise. See gain adjustments, Figure 7. This will allow R10 to be readjusted toward the maximum position and achieve the proper flame discrimination.

6. Repeat the above steps on each burner. A check at various load levels, LOW-MIDDLE-HIGH, should be made to ensure complete and positive discrimination between each individual flame envelope.

DISCRIMINATION

Some multi burner applications exhibit a high degree of background and adjacent flame activity. To achieve good discrimination, it may be necessary to reduce the signal level at the viewing head by backing-off (anti-clockwise) the gain potentiometer. (1 in the IR & IRGS, 2 in the 1RX2).

MULTIFUEL SYSTEMS

A second sensitivity potentiometer (R9) is available for the additional fuel. Proceed as above for the second fuel.

FINAL CHECKOUT

Before putting the system into service, run through at least five complete cycles to verify proper operation.

INSTRUCTIONS FOR FILTERS USING THE DIGITAL DISPLAY.

The digital display will accurately define the flame-out ratio with respect to the burner being monitored and the adjacent or opposite burners and will accurately define the optimum high pass filter to use for a given sighting.

For example, suppose that with a low fire condition the burner being monitored reads 1000 on the display with the high pass filter in the lowest position. With the burner off and adjacent burner at high fire the display reads 250. This is a flame-out ratio of 4. Switching the high pass filter to next higher position may result in readings of 800 to 160 respectively. This is now a flame-out ratio of 5 that can be considered an improvement switching the high pass filter to the highest position may result in readings of 400 and 40. This would be a 10:1 flame-out ratio, which would be a further improvement. The analogue board sensitivity could then be adjusted with this filter position so that the maximum flame signal reads between 15 and 20 on the analogue meter, (high fire condition). A low fire condition should not cause the flame relay to drop out. If it does the sensitivity should be increased just enough to satisfy this low fire condition. Obviously with the burner off the flame relay must drop out regardless of the conditions of the adjacent or opposing burners. In this manner the analogue board, which is the principal signal processor, can be accurately adjusted and the proper high pass filter chosen.

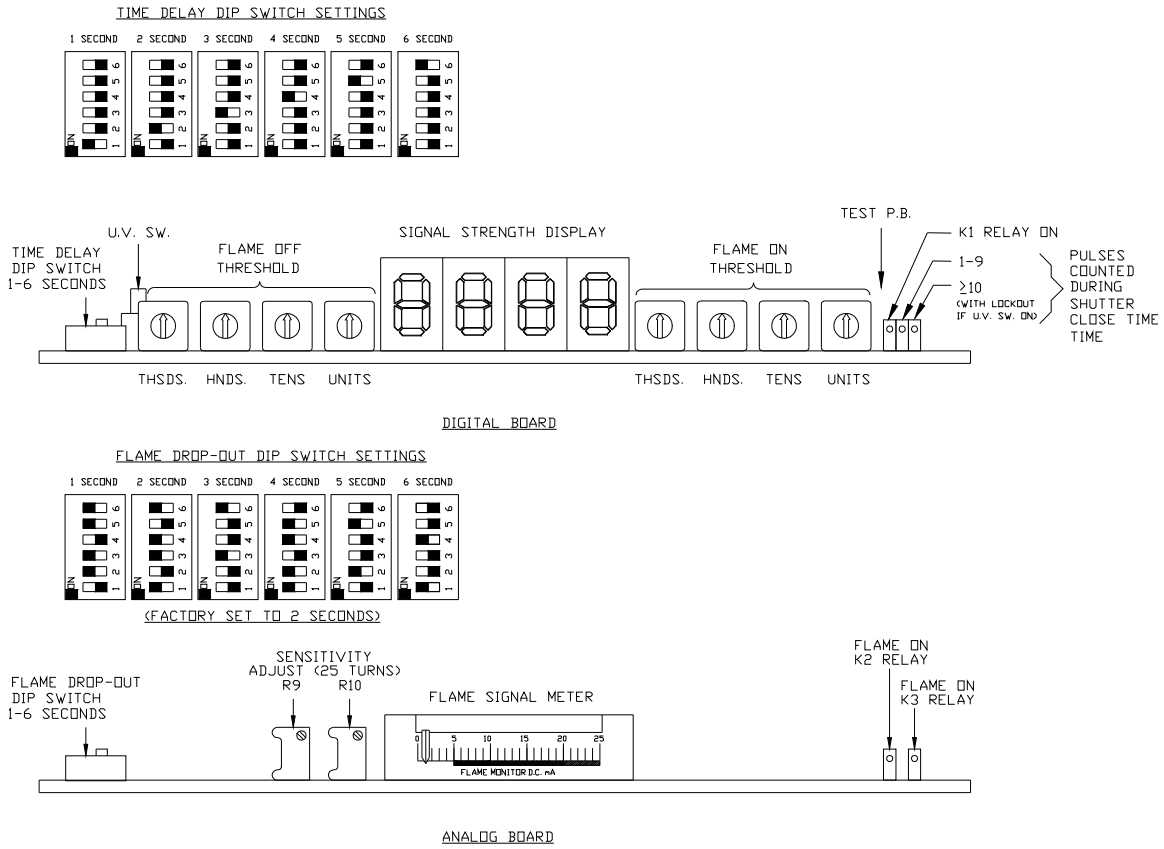
TIME DELAY DIP SWITCH SETTINGS
1 SECOND
2 SECOND
3 SECOND
4 SECOND
5 SECOND
6 SECOND
U.V. SW.
TIME DELAY DIP SWITCH 1-6 SECONDS
FLAME OFF THRESHOLD
SIGNAL STRENGTH DISPLAY
FLAME ON THRESHOLD
TEST P.B.
K1 RELAY ON
1-9
≥10
(WITH LOCKOUT IF U.V. SW. ON)
PULSES COUNTED DURING SHUTTER CLOSE TIME
THSDS. HNDS. TENS UNITS
THSDS. HNDS. TENS UNITS
DIGITAL BOARD
FLAME DROP-OUT DIP SWITCH SETTINGS
(FACTORY SET TO 2 SECONDS)
FLAME DROP-OUT DIP SWITCH 1-6 SECONDS
SENSITIVITY ADJUST (25 TURNS)
R9
R10
FLAME SIGNAL METER
FLAME MONITOR D.C. mA
FLAME ON K2 RELAY
FLAME ON K3 RELAY
ANALOG BOARD

Figure 7

TROUBLESHOOTING

CAUTION

- To prevent blow back when the combustion chamber has a positive pressure, make sure the airflow through the aspirator equals or exceeds the value required for seal off (Figure 6) before unlatching the detector.
- Use utmost care while troubleshooting the system. Line (230 VAC) voltage is present on Terminals 1 and 2 of the flame safeguard control when energised and (24 VDC on Terminals 4, 5, and 15 VDC on Terminal 6).
- Before making a replacement, make sure you have the correct part, by model number.
- Upon completion of troubleshooting, be sure to perform the adjustments and checkout beginning on Page 12.

GENERAL PROCEDURES

If you are using remote sensitivity selection, make sure that the external selector switch is open if adjusting sensitivity control R1O or closed if adjusting sensitivity control R9.

Make sure sight pipe is clear and has an unobstructed view of the burner throat.

EQUIPMENT REQUIRED

Volt-Ohm Meter.

Replacement parts - see specification section.

PROBLEM:

ZERO FLAME SIGNAL READING ON ANALOG BOARD AND/OR ZERO COUNT RATE ON DIGITAL BOARD

1. Refer to wiring diagrams pages 11 and 12 for terminal locations.
2. Check for proper line voltage. Connect an AV voltmeter across terminals 1 and 2 on the terminal block make sure the AC voltage measured is within the voltage range listed under Specifications.
3. If there is no voltage, make sure line voltage power is connected to the master switch, the master switch is closed, and overload protection (circuit breaker, fuse, or similar device) has not opened the power circuit.
4. Check fuses F1, F2, F3 and F4.
5. If the measured voltage is not within the proper voltage range, make sure the main power supply is of the correct voltage and frequency. Then trace the wiring between the amplifier and the main power supply to determine the problem.

6 On the UV head only, determine if the self-checking shutter is open by looking into the front of the detector through the lens. If the shutter is not open, connect a DC voltmeter across Terminals 3 and 6 on the terminal block. The DC voltage measured, should be approximately 13.6 VDC intermittent once a second.

7 If the proper voltage is present, replace the viewing head.

8 If the shutter is open, make sure the sensitivity control on the plug-in electronics chassis is not set too low for the flame conditions encountered. (Refer to adjustments and checkout section).

9 Replace integrated circuit U7 (4538) on the motherboard.

PROBLEM:

WARNING LIGHT ILLUMINATED WHEN USING ULTRA-VIOLET VIEWING HEAD

(Detector tube is firing one to nine times when shutter is closed).

1. Depress reset button on cover or on motherboard.
2. Replace the ultraviolet tube if the system does not reset

PROBLEM:

NO DISPLAY ON DIGITAL BOARD AND NO ANALOG SIGNAL, BOTH WARNING AND FAILURE LIGHTS ILLUMINATED

(Detector tube is firing more than nine times when shutter is closed).

1. Depress reset button on cover or on motherboard.

2. If system does not reset, replace the ultraviolet tube.

NOTE: -The following potentiometers are factory set, and must never be adjusted - R7, R8, R13 and R18.

PERIODIC MAINTENANCE

Scheduled replacement of detector components is normally not necessary.

Keep the flame detection system adjusted for safe and reliable operation.

Ultraviolet radiation is poorly transmitted through most media A light film of oil mist or smoke on the quartz lens may have an adverse effect on the flame signal. If air purging is not completely effective in keeping the lens clean, then set up a schedule for cleaning the viewing lens regularly. Use a soft, clean cloth. A cloth dampened with a concentrated detergent solution is recommended. If the lens is damaged, or it is coated with a substance that cannot be cleaned off, replace it.

Replace the silicon-rubber 0-rings, which seal the cover plate if they are damaged or deteriorated.

Humidity effects: Good engineering practice dictates that electronic equipment be kept continuously powered, even when not in use, to minimise any possible adverse effects of high humidity. If electronic hardware remains un-powered for extended periods of time, turn the power on 48 hours before resuming operation. It is recommended that spare parts be rotated every six months for this same reason.