

MATERIAL AND EQUIPMENT STANDARD

FOR

LOW VOLTAGE INDUSTRIAL AND FLAMEPROOF

a.c. SWITCH-FUSE ASSEMBLY

CONTENTS :	PAGE No.
1. SCOPE	4
2. REFERENCES	4
3. DEFINITIONS	5
4. UNITS	6
5. SERVICE CONDITIONS.....	6
6. BASIC DESIGN AND CONSTRUCTION OF SWITCH FUSE ASSEMBLY	7
6.1 Multibox Type Assembly	7
6.1.1 Busbars and connections	7
6.1.2 Incoming Units	8
6.1.3 Outgoing Units (Feeders).....	8
6.1.4 Bus section switching unit	9
6.1.5 Incoming and outgoing cable connections.....	9
6.1.6 Auxiliary Circuits.....	10
6.1.7 Prevention of Condensation	10
6.1.8 Electrical indicating instruments.....	10
6.1.9 Safety and reliability	10
6.1.10 Earthing and bonding.....	10
6.1.11 Extension	11
6.1.12 Spare boxes (units).....	11
6.1.13 Rated values of switching devices	11
6.1.14 Nameplates and labels	11
6.2 Cubicle or Multicubicle Type Switch Fuse Assembly	12
6.2.1 Busbars and connections	13
6.2.2 Incoming, outgoing, and bus section switching devices.....	13
7. INSPECTION, QUALITY CONTROL AND QUALITY RECORDS	13
8. TESTS AND CERTIFICATES.....	13
8.1 General Requirements for Tests	13
8.2 Specific Requirements for Tests	13
9. FINISH	15
10. INFORMATION FOR MANUFACTURER (SUPPLIER).....	15
11. DOCUMENTATION/LITERATURE TO BE SUBMITTED BY MANUFACTURE R/SUPPLIER	16
11.1 At Quotation Stage	16

11.2 At Ordering Stage	16
12. PACKING	17
13. SHIPMENT	17
14. GUARANTEE	17
15. SPARE PARTS	17
16. LANGUAGE	17
17. COORDINATION RESPONSIBILITY WITH OTHERS	17

APPENDICES :

APPENDIX A	EXAMPLE OF TYPICAL SINGLE LINE DIAGRAM FOR LOW VOLTAGE a.c. SWITCH FUSE ASSEMBLY	18
APPENDIX B	TYPICAL LOW VOLTAGE a.c. SWITCH FUSE ASSEMBLY DATA SHEETS	19
APPENDIX B1	EXAMPLES OF INDUSTRIAL AND FLAMEPROOF SWITCH FUSE ASSEMBLY	23
APPENDIX C	GUIDANCE FOR DESIGNATION OF CIRCUITS OF SWITCH FUSE ASSEMBLY TO BE ENGRAVED ON PERTINENT LABELS	24
APPENDIX D	LIST OF DRAWINGS, DOCUMENTS, MANUALS AND CERTIFICATES TO BE SUBMITTED BY MANUFACTURER/SUPPLIER AT QUOTATION AND ORDERING STAGE.....	25
APPENDIX E	ADDITIONAL REQUIREMENTS FOR SWITCH FUSE ASSEMBLY IN POTENTIALLY EXPLOSIVE GAS ATMOSPHERES	26
APPENDIX E1	CONNECTION OF EXPLOSION, PROTECTED ELECTRICAL EQUIPMENT TO EXTERNAL CIRCUIT (CABLE ENTRIES)	28

ATTACHMENTS (General) :

ATTACHMENT 1	ENVIRONMENTAL CONDITIONS.....	29
ATTACHMENT 2	INSPECTION, QUALITY CONTROL AND QUALITY RECORDS.....	30
ATTACHMENT 3	TESTS AND CERTIFICATION.....	31
ATTACHMENT 4	PACKING.....	32
ATTACHMENT 5	SHIPMENT.....	33
ATTACHMENT 6	GUARANTEE.....	34
6.1	Clearance of Defects	34
6.2	Replacement of Defective Parts	34
6.3	Supply of Spare Parts	34
6.4	After Sale Technical Services.....	34
ATTACHMENT 7	SPARE PARTS	35
ATTACHMENT 8	LANGUAGE.....	36
ATTACHMENT 9	COORDINATION RESPONSIBILITIES WITH OTHERS.....	37
ATTACHMENT 10	GENERAL CONDITIONS OF PURCHASE.....	38
ATTACHMENT 11	SAMPLE OF PURCHASER'S DRAWING TITLE BLOCK.....	39
ATTACHMENT 12	INSTRUCTIONS OF PURCHASER ABOUT PERTINENT DRAWINGS.....	40
ATTACHMENT 13	MATERIAL, LAYOUT AND LETTERING OF LABELS	41
ATTACHMENT 14	FULL ADDRESS OF PURCHASER	43

1. SCOPE

1.1 This Standard Specification covers the minimum technical requirements for design, manufacture, quality control, testing, finishing and shipment of low voltage a.c. industrial and explosionproof switch fuse assemblies incorporating air break switches, air break disconnectors, air break switch disconnectors, fuse combination units, and motor circuits the rated voltage of which does not exceed 1000 volt a.c.

This Standard is applicable to both multicubicle type, and multibox type assemblies.

1.2 Only the general requirements of switch fuse assemblies are given in this Standard Specification. The specific requirements of individual assemblies will be given in pertinent data sheet, relevant one line diagram and or requisition.

1.3 This Standard Specification shall be used for the preparation of requisitions and purchase orders and subsequently as a guideline for the manufacturers of the equipment described.

2. REFERENCES

The edition of the following Standards and Codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the vendor/consultant:

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 27	"Letters, Symbols to be used in Electrical Technology"
IEC 50(441)	"International Electrotechnical Vocabulary for Switchgears, Controlgear and Fuses"
IEC 51	"Recommendations for Indicating Electrical Measuring Instruments and their Accessories"
IEC 59	"Standard Current Rating"
IEC 73	"Colors of Indicating Lights and Push Buttons"
IEC 79	"Electrical Apparatus for Explosive Gas Atmospheres"
IEC 144	"Degree of Protection of Enclosures for Low Voltage Switchgear and Controlgear"
IEC 157.1	"Low Voltage Switchgear and Controlgear Part 1: Circuit Breakers"
IEC 158.1	"Low Voltage Controlgear Part 1: Contactors"
IEC 185	"Current Transformers"
IEC 186	"Voltage Transformers"
IEC 255	"Electrical Relays"
IEC 269.1	"Low Voltage Fuses with High Breaking Capacity"
IEC 292	"Low Voltage Motor Starter"
IEC 337	"Control Switches (LV Switching Device for Control and Auxiliary Circuits including Contactors)"
IEC 364.4.41	"Protection against Electric Shock"
IEC 364.5.54	"Earthing Arrangements and Protective Conductors"
IEC 391	"Marking of Insulated Conductors"

IEC 408	"Low Voltage Airbreak Switches, Airbreak Disconnectors, Airbreak Switch Disconnector and Fuse Combination Unit"
IEC 414	"Safety Requirements for indicating and Recording Electrical Measuring Instruments and their Accessories"
IEC 417	"Graphical Symbols for use on Equipment"
IEC 439	"Low Voltage Switchgear and Controlgear assemblies"
IEC 445	"Identification of Equipment Terminals and of Termination of Certain Designated Conductors, Including General Rules of an Alphanumeric System"
IEC 446	"Identification of Insulated and Bare Conductor by color"
IEC 447	"Standard Directions of Movement for Actuators which Control the Operation of Electrical Apparatus"
IEC 473	"Dimensions for Panel Mounted Indication and Recording Electrical Measuring Instruments"
IEC 617.7	"Graphical Symbols for Diagrams Part: 7, Switchgear, Controlgear and Protective Devices"
IEC 664	"Insulation Coordination with Low Voltage Systems Including Clearances and Creepage Distances for Equipment"

IPS (IRANIAN PETROLEUM STANDARD)

IPS-M-EL-140	"Material and Equipment Standard for Industrial a.c. Switchgear and Controlgear Assembly"
--------------	---

Notes:

1) Where standards other than IEC are used, manufacturer/supplier shall submit the applied equivalent standards and the pertinent deviations from IEC standards specified.

2) The testing and certification by following Authorities are acceptable where relevant:

- a) Association of Short Circuit Testing Authorities (ASTA).
- b) European Organization for Testing and Certification (EOTC).
- c) Underwriters Laboratories (UL).
- d) Electrical Equipment Certification Services (EECS).
- e) British Approval Services for Electrical Equipment in Flammable Atmosphere (BASEEFA).
- f) Physikalisch Technische Bundesanstalt (PTB).

3. DEFINITIONS

In order to have precise and clear definitions for Low Voltage (LV), Medium Voltage (MV), and High Voltage (HV) standards; the ISIRI No. 6 (1987) derived from the IEC standard No. 38 (1983) with some changes, is quoted below:

a) Low Voltage

Low Voltage (LV) is defined as voltage below 1000 volt in a 3 phase 4 wire 50 Hz system.

b) Medium Voltage

Medium Voltage (MV) is defined as voltages higher than 1000 Volt up to and including 66 kV in a 3 phase, 3 wire, 50 Hz system.

c) High Voltage

High Voltage (HV) is defined as voltage higher than 66 kV in a 3 phase, 3 wire, 50 Hz system.

4. UNITS

International system of units (SI) in accordance with IPS-E-GN-100 shall be used.

5. SERVICE CONDITIONS**5.1 Environmental Conditions**

See Attachment 1.

5.2 Electricity Supply

5.2.1 Power supply in site is 400/230 Volt, 3 phase 4 wire, 50 Hz, solidly neutral earthed system.

5.2.2 Fault level

MVA at Volt. (See data sheet).

5.2.3 Voltage variation

± 10% (To IEC 38)

5.2.4 Frequency variation

± 5% (To IEC 242)

5.3 Switch Fuse Assembly in Potentially Explosive Atmospheres

Where the Installation of switch fuse assembly in hazardous areas are unavoidable, additional requirements described in Appendix E shall be fully complied with.

5.4 Loading

The circuit loading shall not exceed 85% of the base rating, however particular attention shall be given to requirements for reliability of equipment under the arduous climatic conditions (upto 50°C) and all materials especially gaskets, plastic moulding insulation, etc. to be able to withstand the adverse climatic conditions without undue deterioration.

5.5 Switching of Capacitors

When feeders are used for the switching of capacitors, fuses require additional derating to two thirds of rating at 50°C.

6. BASIC DESIGN AND CONSTRUCTION OF SWITCH FUSE ASSEMBLY

Two types of switch fuse assemblies constructions are covered by this Standard namely:

- Multibox type assembly for outdoor use.
- Cubicle or multicubicle type assembly for indoor use.

6.1 Multibox Type Assembly

- Multibox type assembly shall comprise metal-clad box type switch fuse, mounted above and/or below metal clad unit type single busbar chamber section, the whole assembly linked together and mounted on free standing steel pedestals suitable for outdoor installation without further protection under environmental conditions specified in Attachment 1.
- The assembly shall comply with the general requirements of Clauses 2.3.3.4 and 2.3.3.5, and Fig. C6 of IEC publication 439.1.
- Depending on the location of assembly one of the following minimum degree of protection of the enclosure against contact with live or moving parts and against ingress of solid foreign bodies and liquids as per IEC publication 144 shall be selected:

- Indoor in enclosed building	IP 41
- Outdoor protected by canopy	IP 54
- Outdoor unprotected	IP 65

Note:

The above mentioned degree of ingress protection shall be applied only when no mention is made of "IP" in data sheet.

- Electrically Identical Switching devices and components shall be of one type and make, and shall be interchangeable.
- Multibox type assembly shall be suitable for outdoor installation without any further protection as far as weatherproofing is concerned, but some form of sunshade protection is desirable if continuously exposed to full sunlight. Multibox type assembly may also be installed in door in lieu of cubicle type at the discretion of purchaser.
- When outdoor assemblies are requested the supplier shall submit full detailed drawing of canopy to be provided by purchaser.
- The switch-fuse assembly to be complete with all fittings including holding-down bolts and a 50 mm x 6 ½ mm copper earthing bar running the full length of the assembly with a terminal point at each end for connecting the external earthing system.
- The earth terminals shall be protected against corrosion.
- The height of the supporting structure of assembly to be such that the operating handles of switches mounted above the busbars in the closed, or on position are not greater than 1750 mm above the ground level.
- Means shall be provided for lifting the complete assembly or section of it in installed position.

6.1.1 Busbars and connections

6.1.1.1 Single unit type busbar chamber shall contain the requisite number of hard drawn high conductivity electrolytic air insulated copper busbars adequately braced and secured by insulated supports.

6.1.1.2 Normal current rating shall be in accordance with Subclause 4.2 of the IEC publication 439.1, however it shall be derated for ambient temperature as described in Attachment 1.

6.1.1.3 The neutral busbar shall have half the cross section of the phase bars under normal condition, and shall be provided with neutral link.

6.1.1.4 The neutral busbar shall be perfectly insulated from metallic surrounding however means shall be provided for earthing the neutral busbars where necessary.

6.1.1.5 The busbars shall not be tapered.

6.1.1.6 The copper connections to the outgoing circuits shall be rigidly bolted.

Busbar short time rating shall not be less than 1 second.

6.1.1.7 Busbars and connections shall be sheathed with color coded self extinguishing shrunk on sleeving.

6.1.2 Incoming Units

6.1.2.1 Incoming units which are generally similar to outgoing feeders, shall be one of the following as shown in single line diagram and or described in data sheet:

Switch-fuses	IEC 408
Switch disconnecter/switch-isolator	IEC 408
Air circuit breakers	IEC 157.1

6.1.2.2 The incomer must be installed in the middle of assembly or at the electrical load center of busbar.

6.1.2.3 Incoming isolators together with their supply side and load side connections shall be capable of carrying the peak asymmetrical fault current and the short time rated fault current without damage or danger; they shall also be capable of carrying their rated current continuously.

6.1.2.4 Where air circuit breakers are specified in data sheet, as incoming units, the outdoor weatherproof capability of the switch fuse assembly shall not be impaired.

6.1.2.5 Devices shall be suitable for the particular application to which reference is made in Appendix C.

6.1.2.6 The closed and the open positions of the switching devices shall be definite and shall be clearly indicated either adjacent to the actuator or by the position of the latter.

"Closed" and "Open" shall be used to indicate the on and off position respectively.

6.1.2.7 Where fuses and switches of airbreak switch disconnectors and fuse combination units are mounted in separate enclosures, they shall be interlocked such that fuse compartment door cannot be opened unless the switch is open, and the switch cannot be closed unless the fuse compartment door is closed.

6.1.3 Outgoing Units (Feeders)

6.1.3.1 The outgoing circuits may be controlled by one of the following devices selected from data sheet in Appendix B.

Disconnecter (isolator)	IEC 408
On load type switch disconnecter	IEC 408
Switch disconnecter with automatic	IEC 408
Airbreak disconnecter and fuse combination unit IEC 408 Switch fuse	IEC 408
Moulded case circuit breaker	IEC 157.1
Fuse with mechanical linkage for alarm or release	IEC 269

6.1.3.2 The switch fuse enclosure shall be of cast metal or heavy gage sheet steel construction, with hinged or bolted gasketed cover suitable for outdoor installation.

6.1.3.3 All enclosures shall be securely bolted to the busbar chamber and effectively bonded to the main switch fuse assembly earth bar.

6.1.3.4 The switches shall be of the load break type with the quick make, quick break spring assisted mechanism.

6.1.3.5 The operating handle of switch shall be suitable for pad locking in the off position and mechanically interlocked with the fuse compartment cover, so that fuses cannot be replaced unless the switch is in the off position.

- It should not be also possible to return the handle to the on position until the fuse compartment cover is closed and bolted tight.

- Both the on and off positions shall be positively indicated.

6.1.3.6 The fixed and moving contacts shall be silver plated unless otherwise specified in requisition, and there shall be two breaks per pole.

- Fixed contacts shall be screened to prevent accidental contact.

6.1.3.7 Isolators connected in the supply side of fuses together with their supply side and load side connections shall be rated for main incoming isolators.

6.1.3.8 Isolators connected in the load side of fuses together with their supply side and load side connections shall be capable of carrying the peak asymmetrical let through current of the fuses, and shall be capable of carrying the let through current of the fuses for the total break time, for any current throughout the current/total break time characteristic of the fuse that is fitted into the fuse base holder or carrier.

6.1.3.9 Switching devices supplying LV, 3 phase 4 wire loads, shall have a switched neutral, unless otherwise specified in data sheet.

- L.V. single phase and Neutral loads shall be controlled by a double pole switch, with a single pole high breaking capacity (HBC) fuse, and a solid neutral link.

- The switched neutral to make first and break last.

6.1.3.10 Fuses shall be of the high breaking capacity type to IEC publication No. 269 .

- Fuse sizes protecting circuits which supply motors shall be kept to a minimum compatible with the starting time and current of pertinent motors.

- Fuse carriers shall be such that when they are withdrawn, the operator is protected from accidental contact with any live metal of the fuse link and fuse contacts.

6.1.4 Bus section switching unit

Bus section switching device shall be similar to units selected for incoming switch device (see Clause 6.1.2 of this Standard Specification).

6.1.5 Incoming and outgoing cable connections

6.1.5.1 All incoming and outgoing switching devices shall be provided with compression type cable glands suitable for cables referred to in data sheet.

6.1.5.2 Cable plates, cable lugs, cable supports, cable clamps, and cable cleats shall be included where applicable for incoming and outgoing cables.

- Cable glands and plates shall be so located as to allow easy termination of cables.

6.1.5.3 Non-corrosive and non-ferrous stud bolts with washers, nuts and interlocks shall be provided for external power cable(s) including neutral conductor connection sized to suit the cable core size.

6.1.5.4 Provision shall be made for cable earthing at glands and positive fixing to earth busbar.

6.1.5.5 Cable entries to be preferably from below unless otherwise specified in data sheet.

6.1.6 Auxiliary Circuits

6.1.6.1 The rated current of auxiliary circuit shall not be less than 6 Amps, and the rated voltage and frequency of the auxiliary circuits where specified shall be the same as those of the main circuit.

6.1.6.2 For number of auxiliary contacts and their type whether "a" contact (make) or "b" contact (break) see data sheets in Appendix B.

6.1.7 Prevention of Condensation

6.1.7.1 A breather or similar device shall be provided to prevent the harmful accumulation of moisture inside the switch fuse assembly.

6.1.7.2 Where anti condensation heater(s) are required they shall be provided with isolating switch fuse and thermostat; unless otherwise specified in requisition.

6.1.8 Electrical indicating instruments

6.1.8.1 The number and type of instruments for the assembly shall be in accordance with the requirements stated in data sheet. (See Appendix B).

6.1.8.2 Instruments shall be of flush mounted industrial grade, enclosed, in a dust and damp proof casing, non-projecting dial, with non-glare, non-reflecting window and in compliance with requirements of pertinent parts of IEC publications 51, and the accuracy shall be Class 2.5.

6.1.8.3 Ammeters in motor starting circuit shall have a compressed overload end scale of at least "6" times the full load motor current.

Indication shall be of the actual values.

6.1.8.4 Ammeters, voltmeters, selector switch etc. shall be contained in weatherproof cases mounted on the front of the busbar chamber or installed in a separate weatherproof mounted above or below the busbars.

6.1.8.5 Small instruments wiring shall be carried out in single core stranded copper conductor with heat resisting PVC insulation neatly laid up and securely cleated in position.

- The cross sectional area of the conductor shall not be less than 2.5 mm.

6.1.9 Safety and reliability

6.1.9.1 Switch fuse assembly shall be designed to minimize any risk of short circuit, and to ensure personal and operational safety during all operating conditions, inspection, maintenance, the connection of mains control and auxiliary cables and equipping and commissioning of spare boxes (sections and compartment in cubicle type) as dictated by requirements.

6.1.9.2 Under no circumstances, the safety requirements and proper functioning for the use intended, shall be less than the requirements of IEC publication 364-5-537 which is for isolation and switching devices.

6.1.10 Earthing and bonding

6.1.10.1 The exposed conductive parts such as chassis framework and fixed part of metal enclosure other than those which do not constitute a danger, shall be electrically interconnected and connected to a protective earth terminal for connection to an earth electrode or an external protective conductor.

6.1.10.2 The protective earth shall be readily accessible and so placed that the connection of equipment to the earth electrode or to the protective conductor is maintained when the cover or any removable part is in place.

6.1.10.3 The protective earth terminal shall be suitably protected against corrosion.

6.1.11 Extension

6.1.11.1 The switch fuse assembly including the framework, busbars, bus wiring earth bar etc. shall be suitable in all respects for extension at both ends. So that only the minimum of work will be required to make such extension.

6.1.12 Spare boxes (units)

6.1.12.1 Where spare boxes are specified in the data sheets, they shall be equipped as required in circuit details.

6.1.12.2 Where spare boxes occur due to the layout or arrangement of the assembly, or where no specific requirements are given in the data sheet for the required spare boxes, they shall be provided with the minimum requirements to ensure safety when required to be used.

6.1.13 Rated values of switching devices

The following ratings of switching devices shall comply with the requirements of Clause 4.3 of IEC publication 408, in conjunction with data sheets in Appendix B.

6.1.13.1 Rated voltage

6.1.13.2 Rated currents

6.1.13.3 Rated frequency

6.1.13.4 Rated duty

6.1.13.5 Rated making capacity

6.1.13.6 Rated breaking capacity

6.1.13.7 Rated short time withstand current

6.1.13.8 Rated short circuit making capacity

6.1.13.9 Rated conditional short circuit current

6.1.13.10 Rated fused short circuit current

6.1.13.11 Utilization category

6.1.13.12 Mechanical endurance

6.1.13.13 Electrical endurance

6.1.14 Nameplates and labels

6.1.14.1 The nameplates, labels and their fixing materials shall be proven, durable under the service conditions specified for the switch fuse assembly in Attachment 1, they shall be corrosion and moisture resistant and provided with indelible inspection in the language specified in Attachment 8.

- Stainless nameplates and traffolite labels are acceptable.
- Holes for fixing of nameplates or labels shall not influence in any way the degree of ingress protection of enclosure.

Note:

For material layout and lettering of labels (see Attachment 13).

6.1.14.2 The nameplate(s) shall be attached to the equipment and shall be located in places such that they are visible and legible when equipment is installed.

The following information shall be given on nameplate(s):

- a) Purchaser's name and order No.
- b) The year of manufacture.
- c) The manufacturer's name and trade mark.
- d) The designation or serial number.
- e) Number of relevant standard.
- f) Rated operational voltages.
- g) Utilization category and rated operational current (or rated powers), at the rated operational voltages of the equipment.
- h) The value of the rated frequency.
- i) Rated insulation voltage.
- j) Rated thermal current.
- k) Rated duty.
- l) Rated short time with stand current together, with its duration where applicable.
- m) Rated short circuit making capacity where applicable.
- n) Rated conditional short circuit current if applicable (and reference to pertinent clause of relevant standard).
- o) Rated fused short circuit current with prescribed fuse links, where applicable.
- p) Degree of Ingress Protection (IP).
- q) Measures for protection of persons.
- r) Service conditions for indoor use, outdoor use or special use.
- s) Type of system earthing for which the assembly is designed.
- t) Dimensions: height, width (length), and depth.
- u) Weight.

Note:

For designation of circuits see Appendix C.

6.2 Cubicle or Multicubicle Type Switch Fuse Assembly

- The assembly design and construction shall be in general in compliance with the requirements of IEC publication 439.1 Part 1 Clause 7 with due consideration to environmental conditions stated in Attachment 1.

- Indoor type version shall be constructed from heavy gage sheet steel into cubicles and bolted together to form a switch-fuse assembly comprising: switching devices (specified in data sheet) installed in tier formation and suitable for indoor installation.

- Minimum degree of protection of the enclosure against contact with live or moving parts and against ingress of solid foreign bodies and liquids as per IEC publication 144 shall be IP 41 for indoors in enclosed building.
- The switch fuse assembly shall also be vermin protected.
- The assembly compartments shall have hinged steel doors or alternatively the switching devices may be of withdrawable type.
- The number of tiered compartments per cubicle shall be so selected that the operating handles of the upper switching device in the closed or "on" position are not greater than 1750 mm above ground level.
- The sections of the assembly housing of the busbars shall be separate from the switching device compartment, and shall normally be suitable for rear access.
- The rear of the assembly shall be fitted with the removable or hinged steel sheets.
- Cable entries shall normally be vertically upward from ground level unless otherwise specified in data sheet.
- Lifting eye, bolts, lugs or angles shall be furnished for crane hook up of slings during installation.

6.2.1 Busbars and connections

Busbars and connections shall be as generally described under Clause 6.1.1 for box type assembly busbar, except that cubicle type switch fuse assembly busbars droppers and connections shall also be sheathed with color coded self-extinguishing shrunk on sleeving.

6.2.2 Incoming, outgoing, and bus section switching devices

- These devices shall be as generally described for multibox type assembly but suitable for flush mounting cubicle installation.
- The operating handle shall comply with the requirements of IEC publication 447 group 1 for action of control devices and the correlated final effects.

Note:

Sub-clauses 6.1.5 to 6.1.14 specified for multibox type switch fuse assembly are also applicable to cubicle or multicubicle version of the switch fuse assembly.

7. INSPECTION, QUALITY CONTROL AND QUALITY RECORDS

See Attachment 2.

8. TESTS AND CERTIFICATES

8.1 General Requirements for Tests

See Attachment 3.

8.2 Specific Requirements for Tests

The tests shall consist of but shall not necessarily be limited to:

a) Type Tests

The switch fuse assembly type tests results and certificates, shall be verified for their compliance with the requirements of the following:

- IEC Publications (where applicable)
- IEC 439.1 Clause 8.2
- IEC 408 " 8.1.1
- IEC 269.1 " 8.1 to 8.8
- IEC 158.1 " 8.2
- IEC 157.1 " 8.2

b) Routine Tests

The switch fuse assembly shall be subject to routine test in compliance with the requirements of the following IEC publications (where relevant).

- IEC 439.1 Clause 8.3
- IEC 408 " 8.3
- IEC 158.1 " 8.3
- IEC 157.1 " 8.3

c) Final Physical Check

In addition to verification of type tests and witness of routine tests, the following checks shall be made before shipment of assembly:

- The degree of ingress protection.
- The effectiveness of reliability of operating mechanism of:
 - Key Locks
 - Interlocks, and
 - Transfer switches
- Proper functioning of control devices.
- The internal wiring and cabling for proper marking, tightness and provision of contacts for remote control (where applicable).
- The suitability of clamping, earthing termination and marking arrangement for incoming and outgoing cables.
- Simulation of remote control operation where applicable.
- Control of anti condensation heater(s) if any.
- The soundness of instruments.
- The correctness of circuit designation labels.
- The completeness of data on nameplate(s).
- The presence of danger sign in visible places.
- Verification of compliance of main and auxiliary circuits with the approved schematic circuit diagram.
- Fuse rating of individual circuits are correct and derated for site conditions.
- Interchangeability of identical switching devices.
- Soundness of the units and sections of the assembly.

d) Approval Documents for Explosion Protection of Assembly

Where according to data sheet, electrical apparatus are considered for installation in potentially explosive atmospheres, the manufacturer in addition to requirements mentioned under type tests and routine tests, shall submit the approval documents or certification from relevant authorities mentioned in notes under Clause 2 of this Standard Specification, for both individual devices which make up the assembly and for the assembly as an integrated unit.

Note:

Complete records of the verifications, tests and checks carried out shall be accompanied with the following:

- a) Tests results.**
- b) Certificates from testing and certifying authorities.**
- c) Any instruction and precautions to be followed during erection and cable connection of assemblies for installation in potentially explosive atmospheres.**

9. FINISH

9.1 The equipment shall be cleaned, primed with two layers of antirust under coat and one final layer of durable paint suitable for environmental conditions given in Attachment 1.

9.2 The color of final layer shall be:

- a) lightgrey color No. 631 BS 381C; or**
- b) as specified in requisition.**

9.3 All unpainted surfaces (internal and external) shall have a coat of moisture and fungus resistance varnish.

9.4 All parts that are required to be left bright shall be treated and or coated to prevent corrosion.

10. INFORMATION FOR MANUFACTURER (SUPPLIER)

10.1 Provisional single line diagram.

10.2 Data sheet.

10.3 Circuits designation.

10.4 Control power supply.

10.5 Assembly anti condensation heater supply voltage.

10.6 Explosion protection code.

10.7 Whether the equipment may be fitted to a moving device or if it may be exposed in service to abnormal shocks or vibration.

10.8 Type and dimension of electrical connections with the other panel in order to enable manufacturer to provide enclosure and terminals, meeting the conditions of installation and temperature rise allowed for and also to enable him to provide space where necessary to spread out conductors within the enclosure.

10.9 Auxiliary Contacts

The number and type of auxiliary contacts to be fitted on switching devices to satisfy the alarm, indication, and interlocking requirements.

11. DOCUMENTATION/LITERATURE TO BE SUBMITTED BY MANUFACTURER/SUPPLIER

Manufacturer/supplier are to provide at least the following in the quantity and times detailed on the order.

11.1 At Quotation Stage

11.1.1 Supplier shall submit the following:

11.1.1.1 Report of experience background, major clients and annual sale for the similar equipment.

11.1.1.2 Reference list showing the successful operation of equipment offered in major oil industries.

11.1.1.3 Typical type tests certificate of similar equipment.

11.1.2 Declaration of confirmation with the set standards and or clear indication of deviations from the standards and the specifications.

11.1.3 Drawings and documents ticked under column required with quotation in Appendix D.

11.2 At Ordering Stage

11.2.1 Single line diagram:

- a) Preliminary for approval.
- b) Final.

11.2.2 Final certified general arrangement drawings showing floor plan elevation and end views complete with dimensions and mass of assembly.

11.2.3 Final circuit diagrams

11.2.4 Final electrical reference document covering:

- General description.
- Equipment specification.
- Performance data and curves.
- Part and material list.
- List of recommended commissioning spare.
- List of recommended spare parts for three years of operation.

11.2.5 Instruction manuals for:

- Transport and storage.
- Installation.
- Commissioning.
- Operation.
- Inspection/Test.
- Maintenance.
- Illustrated spare part list including special tools.

11.2.6 Certificates:

- List of applicable type test certificates.
- Final test certificates.
- Certificate of quality assurance.
- Copy of documents of certifying bodies.

12. PACKING

For general requirements: see Attachment 4.

13. SHIPMENT

For general requirements: see Attachment 5.

14. GUARANTEE

See Attachment 6.

15. SPARE PARTS

See Attachment 7.

16. LANGUAGE

See Attachment 8.

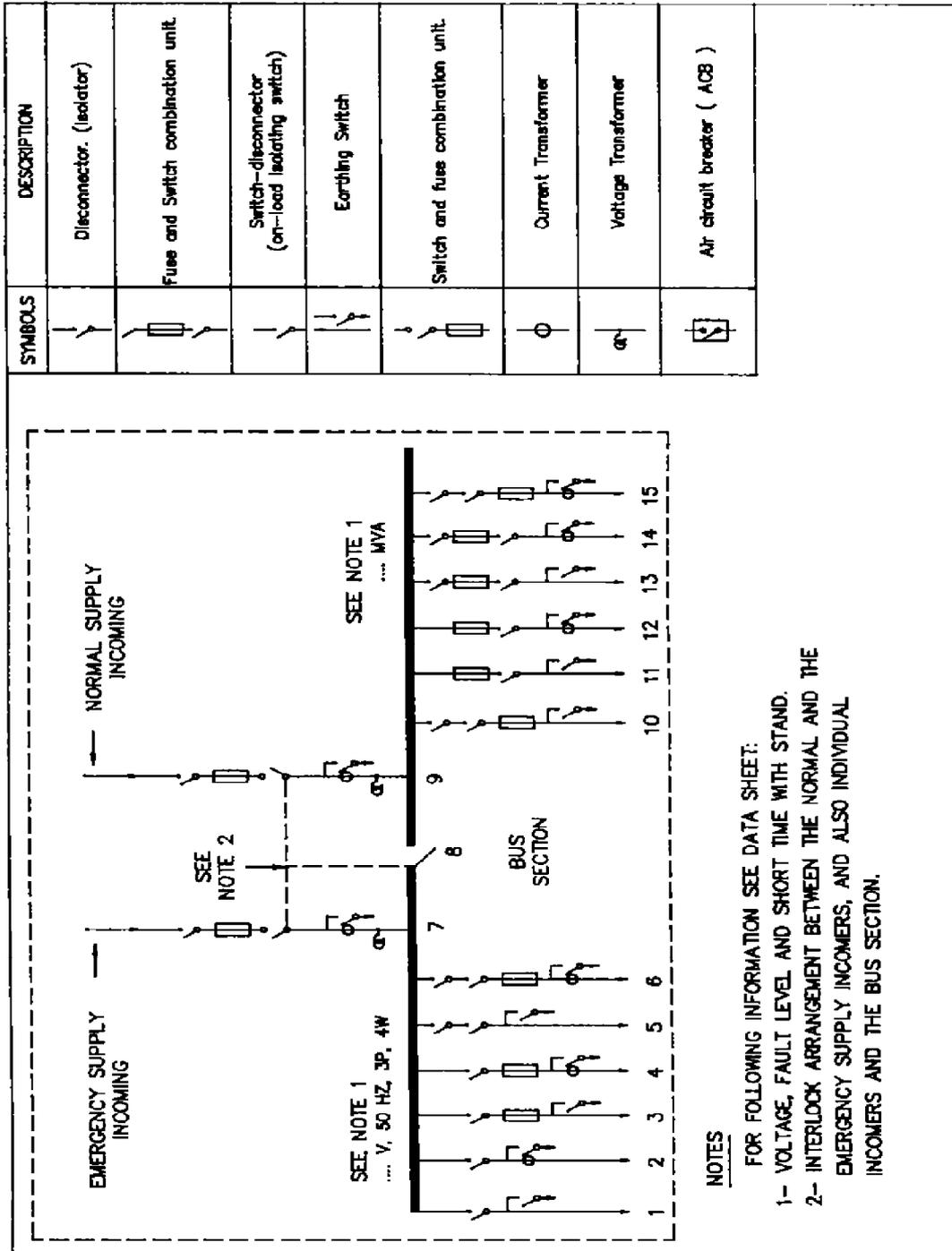
17. COORDINATION RESPONSIBILITY WITH OTHERS

See Attachment 9.

APPENDICES

APPENDIX A

EXAMPLE OF TYPICAL SINGLE LINE DIAGRAM FOR LOW VOLTAGE
a.c. SWITCH FUSE ASSEMBLY



APPENDIX B**TYPICAL LOW VOLTAGE a.c. SWITCH FUSE ASSEMBLY
DATA SHEETS**

PROJECT NAME.....

AREA CLASSIFICATION TO IEC 79.10 :

Safe.....Zone 2.....Zone 1.....

Explosion protection to IEC 79:.....

Ignition temperature of gas/vapor in site.....°C

Group of gas in site.....

Temperature of class of Equipment.....

STANDARD SPECIFICATION No......**POWER SUPPLY :**

Voltage.....phase.....wire.....Frequency.....Hz

Fault level.....MVA, short time withstand.....second

Neutral Earthing System.

TYPE OF SWITCH FUSE ASSEMBLY :

Industrial multicubic type:.....

Industrial multibox type:.....

Flameproof/weatherproof multibox type.....

(See Figs. 1,2 and 3 in Appendix B1 which follows) :

Enclosure ingress protection to IEC 144:.....

For indoor equipment.....

For outdoor equipment.....

TYPE OF EQUIPMENT MOUNTING :

Self supporting.....

Wall mounting.....

TYPE OF ACCESS :

Front access to the wall.....

(to be continued)

APPENDIX B (continued)

Rear access off the wall.....

FORM OF ACCESS :

Withdrawable.....Swingout.....Fixed.....

FUNCTION OF SWITCHING DEVICE :

Incoming.....

Bus section.....

Outgoing feeder.....

SELECTION OF SWITCHING DEVICE :

Air Circuit Breaker (ACB).....

Moulded Case Circuit Breaker (MCCB).....

On load type switch disconnecter.....

Disconnecter (isolator).....

Fuseswitches.....

Contactor.....

Fuse with mechanical linkage or strikers.....

Miniature circuit breaker.....

SPARE UNIT (S)**PROSPECTIVE FUNCTION :**

Number of poles.....

Switched neutral.....Linked neutral.....

Rating kW/kVA.....

Control and indication supply: (where applicable)

..... Volt..... d.c..... a.c.....

DESCRIPTION OF SWITCHING DEVICE :

as applicable:

Reference Clause in standard spec.....

No. of poles..... switch neutral..... linked neutral

Circuit No. in single line diagram.....

(to be continued)**APPENDIX B (continued)****DESCRIPTION OF LOAD :**.....

Power factor of load: Leading..... Lagging.....

Ratedsitecurrent.....
 Utilizationcategory.....
 Classofduty.....
 Ratedmakingandbreakingcapacity.....
 Ratedshorttimewithstandcurrent.....
 Rated short time current with back up fuse.....
 Back up fusestypeandrating.....

AUXILIARY CONTACTS (TYPE AND NUMBER) ON SWITCHING DEVICE

FUNCTION	TYPE	NUMBER
INDICATION		
ALARM		

CABLES

Sizeandtypeofmaincable.....
 Sizeandtypeofauxiliarcable.....

CABLE ENTRY :

Direct..... Indirect..... Conduitsystem

CABLE LUGS :

Formaincable:.....
 Forauxiliarcable:.....

INTERLOCKS BETWEEN INCOMERS AND BUS SECTION :

Whether on failure of normal incoming supply, the incoming form emergency source should feed:

- a) Both sides of bus section.
- b) Only left side of bus section.

(See single line diagram in Appendix A.)

(to be continued)

APPENDIX B (continued)

INDICATING INSTRUMENTS :

Voltmeter.....
 ammeter.....

CURRENT TRANSFORMER RATIO FOR :

Localammeter.....

remoteammeter.....

Protection (where applicable)

VOLTAGE TRANSFORMER RATIO FOR :

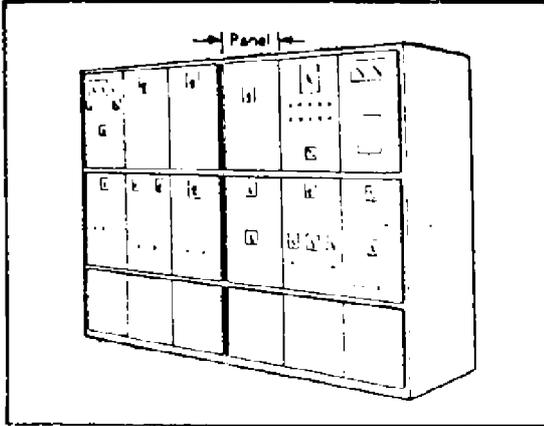
Voltme-
ter.....

Indica-
tion.....

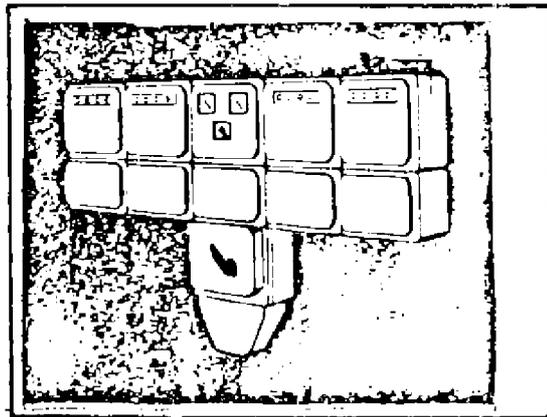
PADLOCKING FACILITY ON SWITCHING DEVICE.....

*** Only applicable points to be filled or ticked in accordance with the specific requirements.**

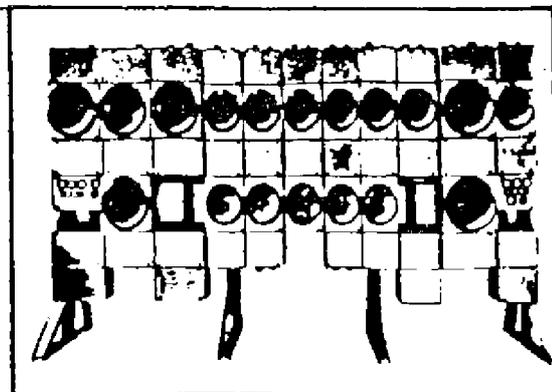
**APPENDIX B1
EXAMPLES OF INDUSTRIAL AND FLAMEPROOF SWITCH FUSE ASSEMBLY**



**FIG.1
INDUSTRIAL MULTI_CUBICLE TYPE
SWITCH_FUSE ASSEMBLY**



**FIG.2
INDUSTRIAL MULTIBOX TYPE
SWITCH_FUSE ASSEMBLY**



**FIG.3
FLAMEPROOF / WEATHERPROOF
TYPE, SWITCH_FUSE ASSEMBLY**

**APPENDIX D
(TYPICAL)**

**LIST OF DRAWINGS, DOCUMENTS, MANUALS AND CERTIFICATES TO BE SUBMITTED BY
MANUFACTURER/SUPPLIER AT QUOTATION AND ORDERING STAGE**

	DESCRIPTION	REQUIRED WITH QUATATION	CERTIFIED INFORM. REQ. WITH ORDER		NUMBER OF WEEKS BEFORE DELIVERY
			N0. OF COPIES		
			REPRO-DICIBLES	PRINTED MATTER	
A	DRAWING AND OTHER DOCUMENTS:				
	a) ELECTRICAL EQUIPMENT:				
	1. DIMENSIONED OUTLINES AND FOUNDATION DETAILS INCLUDING: CABLE ENTRIES AND CLEARANCES				
	2. DETAILS AND CROSS-SECTIONAL ARRANGEMENT				
	3. MOUNTING DETAILS				
	4. PERFORMANCE DATA (TYPICAL)				
	5. PARTS / MATERIAL LIST				
	6. RELEVANT CATALOGUES				
	7. NAME PLATES				
	8. LIST OF FINAL LABELS				
	b) TERMINATION:				
	1. CONNECTION DIAGRAM				
	2. TERMINAL BOX ARRANGEMENT				
	3. CONNECTION AND TERMINAL DESIGNATION				
	c) ELECTRICAL REFERENCE DOCUMENTS:				
	1. GENERAL DESCRIPTION				
	2. EQUIPMENT SPECIFICATION				
	3. PERFORMANCE DATA (ACTUAL)				
	4. DRAWINGS / PARTS / MATERIALS LIST				
B	INSTRUCTION MANUALS : (FOR ALL REQUIRED ITEMS)				
	1. INSTALLATION, COMMISSIONING AND INSPECTION				
	2. OPERATION AND MAINTENANCE				
C	SPARE PARTS REQUIREMENTS:				
	1. ILLUSTRATED SPARE PARTS				
	2. RECOMMENDED COMMISSIONING SPARE LIST				
	3. RECOMMENDED SPARES FOR THREE YEARS OPARATION				
D	CERTIFICATION:				
	1. PERFORMANCE TEST, MATERIALS CERTIFICATES AND CURVES				

APPENDIX E
ADDITIONAL REQUIREMENTS FOR SWITCH FUSE ASSEMBLY IN POTENTIALLY EXPLOSIVE
GAS ATMOSPHERES

1. Enclosure of equipment shall be certified to requirements of:
 - 1.1 IEC Publication 79-0, part 0
General requirements.
 - 1.2 IEC Publication 79-1, part 1
Construction and test of flameproof enclosure of electrical apparatus. Type Exd (EExd).
 - 1.3 IEC Publication 79-7, part 7
Construction and test of electrical apparatus type Exd (EExe).
2. Components for cable glands, conduit fillings and stopping plugs shall be subject to "BASEEFA" or similar authority such as "UL" or "PTB" approval.
3. Ammeters, voltage and selector switch shall be located in flameproof chamber, with type of explosion protection Exd.
4. Where indirect cable entry is dictated by design, terminal compartment shall have the type of protection Exe (EExe).
5. When single core wires through Explosion Proof conduit are connected to terminals of explosion proof equipment : sealing fittings shall be incorporated at the entrance point to prevent transmission of flame or gas/vapor to other parts of the plant.*
6. Compliance with data in conjunction with the:
 - Grouping of released gas/vapor in site.
 - Ignition temperature of released gas/vapor in site temperature class of equipment.
7. Prevention of condensation in potentially explosive atmospheres:
 - Manufacture/supplier shall state in his quotation the measures that have been adopted to prevent the harmful accumulation of moisture inside the starter due to condensation.
 - However breathing and draining devices shall be so constructed that they are not likely to become unsafe in service.
 - Provision for breathing or draining shall not be made by deliberately increasing the gap of Joints.
 - The dimension of the openings constituting the vent shall provide a margin of safety in relation to the dimensions that can be shown by test certificate to be flameproof.
 - If the device is constructed so that it can be taken to pieces, it shall be designed so that it will not be possible to reassemble the parts in such a way as either to reduce or enlarge the vents.

* Illustration for three types of connection of explosion protected electrical equipment to external circuit (cable entries) are given in Figs. 1,2 and 3 in Appendix E1.

(to be continued)

APPENDIX E (continued)

Note:

When flamepath trap is provided full detail of it shall be given by manufacturer or supplier.

8. Nameplate on individual switching device for installation in potentially explosive atmospheres, shall include the following information in conjunction with explosion protection:

Explosion code..... protection

Standard No.....

Certification date..... No. and

Maximum age..... volt-

Maximum rating..... rat-

Type No.....

Maximum permissible ambient temp..... °C

Gas/vapor group.....

Maximum surface temp. of equipment..... °C

Certification authority and mark:

.....

.....

.....

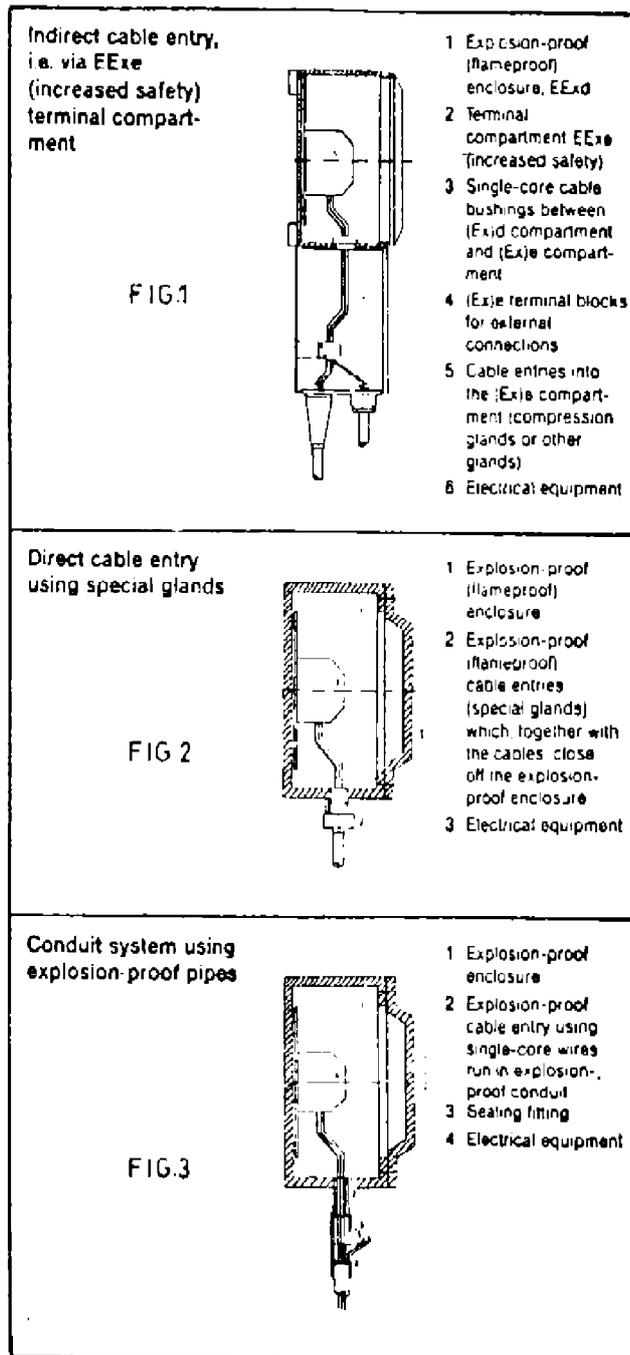
Trade agent mark.....

Note:

Requirements of Clause "6.1.14.2" of this Standard Specification shall also be implemented where applicable.

**APPENDIX E1
(TYPICAL)**

**CONNECTION OF EXPLOSION, PROTECTED ELECTRICAL EQUIPMENT TO EXTERNAL CIRCUIT
(CABLE ENTRIES)**



ATTACHMENTS (General)**ATTACHMENT 1
ENVIRONMENTAL CONDITIONS**

1.1 Site elevation : ----- meters above sea level.

1.2 Maximum ambient air temperature : ----- degrees centigrade. Bare metal directly exposed to the sun can at times reach a surface temperature of ----- degrees centigrade.

1.3 Minimum air temperature : ----- degrees centigrade.

1.4 Relative humidity : ----- percent.

1.5 Atmosphere : saliferous, dusty corrosive and subject to dust storms with concentration of 70-1412 mg/cubic meter, H₂S may be present, unless otherwise specified in data sheet.

1.6 Lightning storm isoceraunic level : ----- storm days/year.

1.7 Maximum intensity of earthquake ----- richters.

Note:

Blanks to be filled by client.

ATTACHMENT 2
INSPECTION, QUALITY CONTROL AND QUALITY RECORDS

2.1 Inspection, Quality Control

2.1.1 The purchaser's inspector, or his authorized representative shall have free access to the manufacturing plant engaged in the manufacture of the equipment, to carry out necessary inspection at any stage of work.

2.1.2 Inspection may include the visit to quality control laboratories, work shops, testing bay etc.

2.1.3 The supplier shall make available technical data, test pieces and samples that the purchaser's representative may require for verification in conjunction with pertinent equipment.

If required the supplier shall forward the same to any person or location that the purchaser's representative may direct.

2.2 Quality Records

2.2.1 The supplier shall maintain appropriate inspection and test records to substantiate conformance with specified requirements.

2.2.2 Quality record shall be legible and relevant to the product involved.

2.2.3 Quality records that substantiate conformance with the specified requirements, shall be retained by manufacturer and made available on request by purchaser.

2.2.4 The supplier shall establish and maintain procedure for identification collection, indexing, filing, storage, maintenance and disposition of quality records.

2.2.5 Supplier shall submit to purchaser: reports, test schedules, and test certificates (in ----- copies) on completion of tests.

Note:

Blanks to be filled by client.

**ATTACHMENT 3
TESTS AND CERTIFICATION**

3.1 General Requirements

3.1.1 Test procedure as proposed by the supplier shall be agreed upon, and approved by the purchaser before any test is carried out.

3.1.2 Purchaser may require witnessed tests to be carried out in the presence of his nominated representative who should be informed at least ----- weeks in advance of the date of the tests and confirmed ----- weeks before the tests.

3.1.3 Test certificates and test reports shall refer to the serial No. of the equipment tested and must bear the purchaser's name, order No. and manufacturer's name and seal. The certificates shall be approved by the purchaser before shipment instruction are given.

3.1.4 Approval by the purchaser's inspector or representative shall not relieve the vendor of his commitments under the terms of this specification or any associated order.

3.1.5 The equipment may be rejected if measurement and inspection reveal any discrepancies between quoted figures resulting in purchase order and those measured actually.

3.1.6 Any charges incurred by the tests quoted under heading of specific requirements for tests to be quoted as a separate item and are not to be included in the cost of the equipment.

Note:

Blanks to be filled by client.

ATTACHMENT 4 PACKING

4.1 Equipment must be carefully packed to provide necessary protection during transit to destination and shall be in accordance with any special provision contained in the order.

4.2 Special attention must be given to protection against corrosion during transit, and silica gel or similar dehydrating compound shall be enclosed.

4.3 The method of cleaning preserving and the details of packing including moisture elimination, cushioning, blocking and crating shall be such that to protect the product against all damages or defects which may occur during handling, sea shipment to the port and rough road haulage, to site and extended tropical open air storage generally as client general conditions of purchase see Attachment 10.

4.4 All bright and machined parts must be given the protection against corrosion.

4.5 Ancillary items forming an integral part of the equipment should be packed preferably in a separate container if the equipment is normally cased or crated.

Alternatively the ancillary items should be fixed securely to the equipment and adequate precautions taken to ensure that the item do not come loose in transit or be otherwise damaged.

4.6 The supplier shall provide methods of handling to prevent damage and or deterioration during transit.

4.7 Where deemed necessary each shipping section shall be furnished with removable steel angles.

4.8 The requirements of above items shall not relieve the supplier of any of his responsibilities and his obligations for delivery of equipment in a sound undamaged and operable conditions at site.

4.9 Identification for Shipment

The marking and labels of products should be legible durable, and in accordance to specification.

Identification should remain intact from the time of initial despatch at work to the final destination.

Marking shall be adequate for identifying a particular equipment in the event that a recall or inspection becomes necessary.

**ATTACHMENT 5
SHIPMENT**

5.1 Motor remote control stations package shall be provided with a permanently attached readily visible identification tag(s) bearing the equipment number of the remote control station to which it belongs.

5.2 The greatest care must be taken to ensure that shipping and associated documents with exact description for custom release are accompanied with the shipment

ATTACHMENT 6 GUARANTEE

6.1 Clearance of Defects

The supplier shall guarantee his equipment during commissioning and for one year operation starting from the completion of seven days continuous service test in site at full load against the following defects:

- All operational defects.
- All material defects.
- All constructional and design defects.

6.2 Replacement of Defective Parts

All defective parts shall be replaced by the supplier in the shortest possible time free of charge including dismanteling reassembling at site and all transportation cost. The above mentioned period shall not however be longer than 18 months from the date of dispatch from the manufacturer's works.

6.3 Supply of Spare Parts

Furthermore the supplier shall guarantee the provision of spare parts to the purchaser for a minimum period of ---- years from the date of despatch.

6.4 After Sale Technical Services

6.4.1 Commissioning

6.4.1.1 The supplier shall quote if required for the services of competent engineer(s) and or technician(s) to assist in installation commissioning and testing of the equipment at site on a per diem basis.

6.4.1.2 The quoted rates shall be irrespective of duration and frequency and the supplier shall guarantee the services of the engineer(s) and technician(s) on the specified date within a minimum of ---- weeks advance notice by the purchaser.

6.4.2 Training

6.4.2.1 The purchaser may require the supplier to arrange for training of his personnel in the manufacturing plant and or in site for the operation and maintenance of the equipment offered.

6.4.2.2 The supplier shall quote (if required) for the cost of any of above mentioned services on a per person per diem basis. The program for the training shall be prepared by mutual agreement. An advance notice of-----weeks minimum, is required by purchaser for the commencement of training program.

Note:

Blanks to be filled by client.

**ATTACHMENT 7
SPARE PARTS**

- 7.1** All spare parts shall comply with the same standards, specification and tests of the original equipment and shall be fully interchangeable with the original parts without any modification at site.
- 7.2** They shall be correctly marked in accordance with client reference and manufacturer part numbers, giving also the purchaser's order number.
- 7.3** Spare parts shall be preserved to prevent deterioration during shipment and storage in humid tropical climate.
- 7.4** List of recommended spare parts and interchangeability with spare parts of similar equipment shall be submitted by supplier.

**ATTACHMENT 8
LANGUAGE**

8.1 All correspondence drawings, documents, certificates, including testing operation and maintenance manuals and spare part lists etc. shall be in English.

8.2 Offers in other languages will not be considered.

**ATTACHMENT 9
COORDINATION RESPONSIBILITIES WITH OTHERS**

- 9.1** In case the equipment ordered should be mounted on, aligned, connected, adjusted, or tested with the equipment of other manufacturer(s) the supplier shall contact directly the said manufacturer(s) and supply and obtain all dimensional and technical informations and arrange for any interconnecting equipment and combined test that may be required.
- 9.2** The supplier shall be responsible for correct and timely communication with the said manufacturer(s) and for any delay and/or cost claims arising from such communications.
- 9.3** Copies of all correspondence should be sent to purchaser.
- 9.4** The name and address of the manufacturer(s) will be given as soon as their orders have been confirmed.

**ATTACHMENT 10
GENERAL CONDITIONS OF PURCHASE**

This document will be submitted by purchaser at the time of ordering.

**ATTACHMENT 11
SAMPLE OF PURCHASER'S DRAWING TITLE BLOCK**

DRAWING NO.		DESCRIPTION				
REFERENCE DRAWINGS						
D						
C						
B						
A						
REV	DATE	DESCRIPTION	REF	CHK	APP	
THE NAME OF RELEVANT COMPANY						
DRAWING TITLE :						
DRN. BY		SCALE	MICRO FILM CODE	PROJECT NO.	CHK. BY	APP. BY
JOB NO.		AREA CODE	DWG. NO.		SHEET	REV.

Note:

Appropriate Nomenclature and Registered mark shall be used for quotation and order.

ATTACHMENT 12
INSTRUCTIONS OF PURCHASER ABOUT PERTINENT DRAWINGS

12.1 Purchaser's drawing title block, "the sample of which is given in Attachment 11 shall be shown in the right lower corner of the drawings.

12.2 Drawings are to be protected and packed. Negatives must be dispatched in a strong card board cylinder.

12.3 Drawings must be rolled and not folded.

12.4 All drawings, documents and literatures shall be forwarded under cover of a fully detailed letter to purchaser whose addresses are given in Attachment 14.

Note:

Blank to be filled by client.

**ATTACHMENT 13
MATERIAL, LAYOUT AND LETTERING OF LABELS**

Label material to be "Traffolite" 5 mm. Thick having two outer layers. Letter to be engraved into the white layer to give black lettering on a white background.

LETTER TYPE

TYPE	HEIGHT	WIDTH mm	STROKE	CASE		LETTERS / 25 mm	SAMPLE
A	5	WIDE	LIGHT	UPPER	CASE	7½ ± 1.2mm. TOL	ABCDEFGHIJKLM
B	5	WIDE	HEAVY	"	"	7½ ± 1.2mm. TOL	
C	5	NARROW	LIGHT	"	"	11 ± 1.2mm. TOL	
D	5	NARROW	HEAVY	"	"	11 ± 1.2mm. TOL	
E	3	WIDE	LIGHT	"	"	10 ± 1.2mm. TOL	
F	3	WIDE	HEAVY	"	"	10 ± 1.2mm. TOL	
G	3	NARROW	LIGHT	"	"	15 ± 1.2mm. TOL	
H	10	WIDE	HEAVY	"	"	3½	
J	12	WIDE	HEAVY	"	"	2½	

Note:

Height is in millimeters.

(to be continued)

ATTACHMENT 13 (continued)

LAYOUTS

LAYOUT 1		LETTERS MAX / LINE	B MIN	8 MIN
LETTER TYPE	G	28	25	4
	E & F	19	4	4
			64	4
				4 DIA. HOLES
LAYOUT 2		LETTERS MAX / LINE	B MIN	8 MIN
LETTER TYPE	G	28	25	4
	E & F	19	4	4
			64	4
				4 DIA. HOLES
LAYOUT 3		LETTERS MAX / LINE	12 MIN	12 MIN
LETTER TYPE	A & B	22	32	4
	C & D	23	5	4
	E & F	30	5	4
	G	45	5	4
			100	4 DIA. HOLES
LAYOUT 4		LETTERS MAX / LINE	12 MIN	12 MIN
LETTER TYPE	A & B	22	32	4
	C & D	23	5	4
	E & F	30	5	4
	G	45	5	4
			100	4 DIA. HOLES
LAYOUT 5		LETTERS MAX / LINE	12 MIN	12 MIN
LETTER TYPE	H	15	32	4
	J	10	5	4
			130	4 DIA. HOLES
LAYOUT 6		LETTERS MAX / LINE	12 MIN	12 MIN
LETTER TYPE	A & B	28	32	4
	C & D	40	5	4
	E & F	40	5	4
	G	58	5	4
			130	4 DIA. HOLES
LAYOUT 7		LETTERS MAX / LINE	12 MIN	12 MIN
LETTER TYPE	A & B	28	32	4
	C & D	40	5	4
	E & F	40	5	4
	G	58	5	4
			130	4 DIA. HOLES

Note:

All dimensions are given in mm.

min. = minimum

