MATERIAL AND EQUIPMENT STANDARD

FOR

LOW VOLTAGE INDUSTRIAL AND FLAMEPROOF

a.c. MOTOR STARTERS

ORIGINAL EDITION

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0. INTRODUCTION

This Standard Specification is based on the combined experience of oil industry specialists in engineering, design, purchase, construction, operation, maintenance and inspection of electrical installations in process and utility plants; and may be applied at every oil refinery, gas establishment and petrochemical plant; thus a large measure of uniformity throughout the procurement will be achieved with all its economic and harmonization advantages.

This Standard may not cover every requirement or diversity of conditions at each locality; but this is recognized and the write up is sufficiently flexible to allow individual companies in oil, gas, and petrochemical industries of Iran to exercise their own judgment in these situations, with due consideration to the existing electrical installations of oil, gas and petrochemical industries in Iran and the pertinent prevailing hazards.

This Standard Specification is mainly for low voltage motor starters for medium voltage motor starting switching device reference shall be made to:

Part 2 of Standard No. IPS-M-EL-140 under title of "Materials, Equipment and Quality Control Standard for Medium Voltage Industrial a.c. Switchgear and Controlgear Assembly".

1. SCOPE

This Standard Specification covers the minimum technical requirements for design, manufacture, quality control, testing, finishing, packing and shipment of low voltage a.c. motor starters for industrial use in both safe and potentially explosive gas atmosphere: to start and accelerate a squirrel cage induction motor to normal speed and to provide means for the protection of the motor, and its associated circuits against abnormal operating conditions and to cause intentionally the motor to stop.

1.2 The a.c. motor starters dealt with in this Standard shall be designed to interrupt short circuit current, therefore suitable short circuit protection should form part of the installation.

The fitting of a main H.B.C. cartridge fuse link assembly inside the motor starter enclosure is optional, however irrespective of the location of the motor main H.B.C. fuses, i.e inside the motor starter or inside a fuse switch feeder, panel on a remote distribution assembly or load center, the bolted H.B.C. fuse link rating shall be selected to suit the actual motor full load current, to IEC publication 269.2 for bolted fuses.

1.3 Only the general requirements of motor starters are given in this Standard Specification. The specific requirements of individual motor starters will be given in pertinent data sheet and or requisition.

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

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSIONS)

IEC 27	"Letters Symbols to be used in Electrical Technology"
IEC 34.12	"Starting Performance of Single Speed 3 Phase, Squirrel Cage Induction Motors for Voltages up to 660V"
IEC 50	"International Electrotechnical Vocabulary"
IEC 51	"Recommendations for Indicating Electrical Measuring Instruments and their Accessories"
IEC 59	"Standard Current Ratings"
IEC 73	"Color of Indicating Light and Push Buttons"
IEC 79	"Electrical Apparatus for Explosive Gas Atmospheres"
IEC 112	"Method for Determining the Comparative and the Proof Tracking Indices of Solid Insulating Material Under Moist Condition, for Creepage and Clearance"
IEC 144	"Degrees of Protection of Enclosures for LV Switchgear and Controlgear"
IEC 157	"LV Switchgear and Controlgear"
IEC 158	"LV Controlgear Part 1: Contactor"
IEC 185	"Current Transformers"
IEC 186	"Voltage Transformers"

IEC 227.3	"P.V.C Insulated Cable Non Sheathed for Fixed Wiring (BS 6231)"
IEC 255	"Electrical Relays"
IEC 269	"LV Fuses with High Breaking Capacity"
IEC 292.1	"Low Voltage Motor Starters Part 1: Direct On-line (Full Voltage) a.c. Starters"
IEC 292.2	"Low Voltage Motor Starters Part 2: Reduced Voltage a.c. Starters Star-delta Starters"
IEC 292.4	"Low Voltage Motor Starters Part 4: Two Step Auto transformer Starter"
IEC 337	"Control Switches (LV Switching) Devices for Control and Auxiliary Circuits Including Contactor Relays"
IEC 364	"Electrical Installation of Building"
IEC 391	"Marking of Insulated Conductors"
IEC 408	"Low Voltage Air Break Switches, Air Break Disconnectors, Air Break Disconnectors and Fuse Combination Units"
IEC 414	"Safety Requirements for Indicating and Recording Electrical Measuring Instruments andTheir Accessories"
IEC 445	"Identification of Apparatus Terminals and General Rules for a Uniform System of Terminal Marking Using on Alphanumeric Notation"
IEC 446	"Identification of Insulated and Bare Conductors by Color"
IEC 447	"Standard Directions of Movements of Actuators Which Controls the Operation of Electrical Apparratus"
IEC 617	"Graphical Symbols for Diagrams"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-M-EL-185	"Material and Equipment Standard for Industrial and Flameproof Motor Remote Control Stations"

Notes:

1) When 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 the following authorities are acceptable where relevant:

a) Association of Short Circuit Testing Authorities (ASTA).

b) European Organization for Testing and Certification (EOTC).

c) Underwriters Laboratorities (UL).

d) Electrical Equipment Certification Services (EECS).

e) British Approval Services for Electrical Equipment in Flammable Atmospheres (BASEEFA)..

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 voltages 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, wire, 50 Hz system.

c) High Voltage

High voltage (HV) is defined as voltages higher than 66 kV in a 3 phase, 3 wire, 50 Hz system. High voltages are mainly used for power transmission and unlikely to have application for the purpose of motor starters standard in this Standard Specification**.**

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. For neutral earthing system see data sheet.

5.2.2 Fault level: MVA at 400 volt (see data sheet).

5.2.3 Voltage variation : ± 10%. (IEC 38).

5.2.4 Frequency variation ± 5%. (IEC 242).

5.3 Motor Starters in Potentially Explosive Atmospheres

5.3.1 Where the installation of motor starters in hazardous areas are unavoidable additional requirements described in Appendix B1 shall be fully complied with.

5.4 Loading

In order to cater for Iran summer operating conditions the manufacturer or supplier should assume that the purchaser's engineer has applied an overall derating factor of 15% other than for H.B.C. cartridge fuse links, when assessing the starter loading requirements, i.e. the motor full load current shall not exceed 85% of the maximum base operational current rating of the starters.

The supplier shall state the base operational rating of the starter in his quotation.

6. BASIC DESIGN AND CONSTRUCTION

6.1 General

6.1.1 Motor starters shall be of the air break and pattern suitable for controlling 3 phase low voltage induction motors.Generally the starters will be for single speed, non reversing direct on line start squirrel cage rotor induction motors. Requirements for other types of starters will be as listed in the equipment schedule.

6.1.2 Each starter shall include the following features:

6.1.2.1 Three pole isolating switch, padlockable and interlocked with the starter, to prevent the cover being opened with the switch in the on position. The switch shall be stalled motor make and break, and shall have mechanical on/off indication .

6.1.2.2 Magnetically operated contactor suitable for class of intermittent duty ‘1’ i.e. upto "120" operating cycles/hour to IEC Publication 158.1 Clause 4.3.4.3 unless otherwise specified. Contacts shall consist of "3" main, 1 retaining, and as a minimum 2 N/o and "2" N/C auxiliaries. Spare auxiliary contacts shall be wired out to terminal blocks for purchaser use, neutral link shall be included for control supply.

Note:

Because of varying practice between manufacturers, the supplier shall state in his quotation whether the "AC3" contactor rating is established on the basis of the AC4 test requirements. For utilization category see Sub-clause 4.3.6 of IEC 158.1 Part 1.

6.1.2.3 Three H.B.C motor circuit fuses to be used as short circuit protection device (SCPD) to IEC 269.1.

The "SCPD" shall be located on the supply side of the starter and have a short circuit breaking capacity not less than the short circuit prospective current at its location. The fuses may be incorporated in the isolator as a fused switch.

6.1.2.4 Control fuses with shrouded contacts for control circuit supply. All control circuits to be separately protected by H.B.C fuses, to IEC 269.1

6.1.2.5 Mechanical design

- The motor starter shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses as well as the effects of humidity and corrosion which are likely to be encountered in normal service.

- Protection against corrosion shall be ensured by the use of suitable materials or by the application of equivalent protective coatings on the exposed surface, taking account of the intended conditions of use and maintenance.

- Enclosure shall be of a mechanical strength sufficient to withstand the stresses to which they may be subjected in normal service.

- No contact pressure shall be transmitted through insulating materials other than ceramic, pure mica or materials with characteristics not less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage of the insulating material.

6.1.2.6 Enclosures

The motor starters covered by this Standard shall comply with the requirements of data sheet from ingress, and explosion protection point of view for class of area mentioned in the same data sheet.

6.1.2.7 Conduit entry

Tapped conduit entries, where provided, shall be metric with 1.5 mm pitch threads and provided with screwed plugs. The enclosures to have the minimum of surface projections.

6.2 Protections

The following protections shall normally be provided:

6.2.1 Instantaneous undervoltage protection inherent in the design of the contactor (on 3 wire control) within the limits of BS. 292.1 : part 1, Clause 7.5.3.4.

6.2.2 Type 1 thermal overload protection, ambient temperature compensated between -40°C to +60°C with single phasing preventer. Manual reset by external push button.

6.2.3 Core balance earth leakage protection shall be fitted to starters for all motors rated 18.5 KW and above, located in zone 2 and safe areas. However, should the starter be controlling an EX(d) (Flameproof) motor in a zone 1 area, C.B.E.L. protection shall be fitted to motors rated 5.5 KW and above. The relay trip setting to be non-Adjustable and to be manually reset only from inside the starter, i.e. not by means of an external push button. The fixed trip setting to be in the range of 2 to 5 AMP.

6.2.4 Temperature trip device operated by positive temperature coefficient (PTC) detectors embedded in the motor winding of motors of over 45 KW one per phase.

- The device shall trip the starter on high motor temperature with indication on the starter front to show that it has operated.

6.2.5 Local combined stop/thermal overload reset push button and provision for remote control in accordance to selected method described in Clause 6.17.

6.2.6 Time delay relays shall be provided for contactors when specified in data sheets, to delay tripping by under voltage and preventing unnecessary outage, following transient supply interruptions. Time delay relays shall be adjustable in the range of 0-4 seconds and the contactors shall reclose immediately on restoration of supply.

6.2.7 Time delay relays shall be provided when called for in requisition to reclose contactors after predetermined delay, following tripping due to power interruptions:

a) Relays shall be adjustable in the range "0-20" seconds or as otherwise specified in data sheets.

b) Particular attention shall be given to the arrangement and position of the calibration device to prevent accidental disturbance.

6.2.8 Other forms of protection may be specified on data sheet in Appendix A.

Note:

To protect star-delta motor during starting period, the current transformer operated, phase connected heaters or directly operated overload heaters must be connected in series with the motor winding in both star and delta states.

6.3 Instrument and Control Transformers

6.3.1 Current transformers

a) Current transformers shall be of the straight through, ring type in accordance with circuits requirements and in compliance with the IEC Publication No. 185. The current transformers shall be mounted on the fixed portion of the equipment on the main bus connections between contactor and main cable terminations.

b) Each "C.T." shall have a short circuiting device. Relevant terminal blocks shall be located

remote from power compartment in a visible and accessible location.

c) Current ratio and polarity marking of all current transformers shall be easily identified after their primary connections have been made.

d) Current transformers for ammeters to have a "1" Amp. secondary winding and rated to carry additional burden of a remote ammeter.

e) Accuracy class of C.T. shall be ,"1" or "3" for measuring, and 5P or 10P for protection as specified inrequisition.

6.3.2 Voltage transformers

a) When voltage transformers are called for measuring instruments or electrical protective devices, they should comply with the requirements of IEC standard No. 186.

b) Each potential transformer shall be protected by disconnect type current limiting primary fuses, and shallbe designed to withstand the basic impulse level of the switchgear.

c) The secondary winding of transformers shall be earthed at one end.

d) Voltage transformers shall be air insulated and of accuracy class 1 or 3 for measuring and 3P for protection as specified in requisition.

e) Voltage ratio required is given in data sheets.

6.4 Ammeters

6.4.1 Ammeters shall be provided for motors rated 5.5 kW and above. Ammeters shall be normally direct operated upto 30 Amp. Where practicable, above 30 Amp. the ammeter to be current transformer operated

6.4.2 Ammeter 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 the requirements of pertinent parts of IEC Publication 51, and the accuracy shall be Class 2.5.

6.4.3 Ammeter shall have a compressed overload end scale of at least 6 to 8 times the full load motor current. Indication shall be of the actual value. The pointer shall be adjustable:

- The limit of current range shall be 60% to 70% of full scale.

The dial to be marked with the:

- Current transformer ratio.
- Accuracy class.
- Serial No. particular.

6.5 Auxiliary Circuit

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

6.5.2 For number, of make and break contacts required see data sheet in Appendix A.

6.5.3 Auxiliary circuit wiring shall be insulated with PVC in accordance with IEC Publication No. 227.3 for (flexibleconductor). The wiring shall be securely held in position and shall not be directly cleated to earthed metal, wiringshould be vermin proof.

Note:

The manufacturer to state in his tender the number and type of auxiliary contacts fitted as standard to the contactor, with provision of necessary wiring.

6.6 Cable and Core Termination

6.6.1 All incoming, outgoing and auxiliary cables shall be provided with, weather proof compression type cable glands suitable for type of cables specified in data sheet .

6.6.2 Cable plates, cable lugs, cable supports, cable clamps, cable cleats and tag No. shall be included where applicable for cables.

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

6.6.3 Cable entries to be preferably from bottom unless otherwise specified in data sheet.

6.6.4 Provision shall be made for cable armor earthing at glands.

6.6.5 Non corrosive, non ferrus stud bolts shall be provided for external cables sized to suit the cable lug.

6.6.6 Identification of insulated and bare conductors by color shall be in accordance with the requirements of IEC Publication No. 446.

6.6.7 Terminal marking for identification purpose shall satisfy the requirements of the IEC Publication No. 445.

6.7 Indication

6.7.1 Unless otherwise specified in data sheet single pilot lamps with colored lens in compliance of IEC publication No. 73 suitable for full line to line voltage shall be fitted to the starter front cover, however low voltage pilot lights are preferred.

6.8 Earth Terminal

6.8.1 All motor starters shall be provided with earth terminals inside and outside the enclosure. They shall be readily accessible and so placed that the earth connection of the starter is maintained when the cover or some other removable part is removed.

6.8.2 Under no circumstances shall a removable metal part of the enclosure be insulated from the part carrying the earth terminal when removable part is in place.

6.8.3 The earth terminal shall be suitably protected against corrosion.

6.8.4 The earth terminal shall be permanently and indelibly marked with the sign

6.8.5 The earthing arrangement shall comply with the requirements of IEC Publication No. 364.5.54.

6.9 Anti-Condensation

6.9.1 Means shall be provided to prevent the harmful accumulation of moisture inside the starter.

6.9.2 Whether or not anti condensation heaters have to be provided is stated in data sheet.

6.9.3 Where anti condensation heaters are provided they shall be suitable for full line to neutral voltage, automatically energized in off position, unless otherwise specified in data sheet.

Note:

For prevention of condensation in potentially explosive atmospheres see Clause 7 in Appendix B1.

6.10 Safety and Reliability

6.10.1 Motor starters 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.

6.10.2 Under no circumstances, the safety requirements and proper functioning of motor starters shall be less than IEC Publication No. 364.4.41 for protection against shock.

6.11 Operating Conditions and Limits

6.11.1 General

Starters shall be trip free. For starters employing contactors, it is also necessary to ensure that when carrying full load motor current continuously, at the ambient air temperature corresponding to the rated characteristics, the overload relay does not trip and interrupt the coil circuit of the starter, as a result of mechanical shocks of operating the contactor.

6.11.2 Limits of operation

Unless otherwise stated, electromagnetic motor starters shall close with any control supply voltage between 85% and 110 % of its rated value and an ambient air temperature between -40°C and +60°C. These limits apply to d.c. or a.c. as appropriate.

Note:

For starters with latched contactors, operating limits should be agreed between manufacturer and purchaser. For electromagnetic motor starters, the drop-out voltage shall be not higher than 75% nor (with worn contacts) lower than 10% of the rated control supply voltage.

The close and drop-out values specified above are applicable after the coils have reached a stable temperature corresponding to indefinite application of 100% Us. In the case of a.c. coils, the voltage limits apply at rated frequency.

6.11.3 Opening by relays or releases

6.11.3.1 Opening by releases with shunt coil An opening release with shunt coil shall operate correctly at all values of supply voltage between 70% and 120% of its rated voltage, under all operating conditions of a starter.

6.11.3.2 Opening by thermal overload relays (see Clause 6.2.2) shall be in compliance with IEC Publications No.292.1 Clause 7.5.3.2 . and due consideration to environment maximum and minimum ambient temperature.

6.11.3.3 Opening by magnetic instantaneous overload relays: For all values of the current setting, magnetic instantaneous overload relays trip with an accuracy of +10% of the value of the current setting.

Note:

Magnetic instantaneous overload relays covered by this recommendation are not intended for short circuit protection.

6.11.3.4 Opening by undervoltage relays or releases. An undervoltage relay or release, when associated with a switching device, shall operate to open the starter even on a slowly falling voltage within the range between 75% and 10% of its rated voltage.

6.12 Rated Values

The following ratings of motor starters shall comply with the requirements of Clause 4.4 of IEC Publications 292.1, 292.2 and 292.4 wherever relevant and in conjunction with data sheet in Appendix A of this Standard Specification:

- Rated voltages.
- Rated currents.
- Rated frequency.
- Rated duty.
- Rated making and breaking capacity.
- Utilization category.
- Mechanical endurance.
- Electrical endurance.

6.13 Contactors, Contactor Coils And Control Supplies

6.13.1 Contactors

Contactors shall comply with the requirements of IEC Publication 158.1. For characteristic of contactors such as : type of contactor, rated values control circuits, auxiliary circuits and degree of ingress protection, reference shall be made to individual circuit requirements in data sheets, however consideration shall be given to the following features:

6.13.1.1 Contactors shall be capable of making on the let through current of the fuse, and capable of carrying the let-through current of the fuse 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.

6.13.1.2 The fuse, overload and contactor rating combination shall be such that the contactor shall not be called by the overload or earth leakage relays to open currents in excess of the contactor breaking capacity.

6.13.1.3 All contactors shall have the class of intermittent duty as specified in the data sheet and as necessary to perform their functions which shall be not less than 30 on load operations per hour.

6.13.1.4 The class of intermittent duty of contactors provided shall be based on the actual starting currents, run up times and running current specified in the data sheets.

6.13.1.5 All contactors shall have making and breaking capacities, in addition to those required for the fault conditions and suitable for the actual starting currents and starting power factors specified in data sheets and as necessary to perform their functions which shall not be less than the following:

a) Normal Operation

(I) Make:

6 × Rated Current

Voltage Before Make 100%

Power Factors 0.35

(II) Break:

Rated Current

Recovery Voltage 17%

Power Factor 0.35

b) Abnormal Operation

(I) Make:

10 × Rated Current up to and including 100A.

Minimum of 1000 A for rating above 100 A.

Voltage before make 110%.

(II) Break:

8 × Rated Current up to and including 100 A

Minimum of 800 A for rating above 100 A

Recovery Voltage 110%

Power Factor 0.35

6.13.1.6 Minimum mechanical endurance for contactors shall correspond to 8000 hours of operation at the highest corresponding frequency of operation.

6.13.1.7 Electrical endurance of contactors shall be not less than th of the number of no load operating cycles corresponding to the mechanical endurance of the contactor.

6.13.1.8 All contactor duty ratings shall be suitable for the motor starting times specified in the requisition but the duty ratings shall be based on not less than the following motor starting times:

a) For pumps 5 secs.

b) For fans 8 secs.

c) For compressors 10 secs.

6.13.1.9 The supply side and the load side of contactors shall also be capable of carrying the normal operating duty cycle currents of the contactors.

6.13.1.10 All contactors shall be suitable for remaining in the on load closed position for long period of time.

6.13.1.11 Isolators associated and interlocked with contactors shall

6.13.1.12 All contactors to be triple pole with normally open air break contacts, two breaks per pole, electromagnetically operated and designed for mounting in any plane from vertical to horizontal.

6.13.1.13 The main line contacts to be renewable and of silver cadmium oxide or equal material with a low erosion rate, good anti-welding characteristics and virtually maintenance free.

6.13.1.14 Contact arc extinction to be achieved through the use of de-ion grids mounted within the arc boxes.

6.13.1.15 The magnet system to be self-aligning, normally a.c. operated, and with a permanent air

gap. Precautions to be taken to obviate contact bounce and the effective absorption of mechanical shock, sound and vibration. The contactor to be suitable for the fitting of auxiliary contacts.

6.13.1.16 The magnet operating coil to be class "F" insulated, continuously rated.

6.13.2 Contactor Coils and Control Supplies

6.13.2.1 Contactor coils shall be suitable for the voltage specified in the data sheets and shall normally be derived from the phase and neutral in four wire systems provided with single pole fusing and between phases in three wire systems provided with two pole fusing.

6.13.2.2 Where the voltage of the contactor coils is specified other than the phase to neutral or the phase to phase voltage, the contactor coil shall be supplied from the transformer mounted in the contactor compartment, unless specified otherwise in the data sheets.

The supply to transformer shall be derived from the contactor circuit with which they are associated.

6.13.2.3 Where d.c. operated latched contactors are specified in the requisition and which require a main external d.c. supply the battery rectifier will be provided by the purchaser unless specified otherwise in the requisition. $\frac{1}{20}$

6.13.2.4 The d.c. supply required for the operation of the protection may be associated with the total protection of the nearest switchgear and controlgear assembly if such assembly exists.

6.14 Direct-on-line Motor Starters

6.14.1 Direct-on-line starters to comply with IEC 292.1: Part 1.

6.15 Star-Delta, Motor Starters

6.15.1 Star-delta starters normally to be of the open transition type and to comply with the applicable section of IEC 292.2.

6.15.2 Three triple pole contactors to be provided for line star and delta, mechanically and/or electrically interlocked to ensure correct sequence of operation. Thermal overload heater elements to be phase connected.

6.15.3 The contactor timing relay to be consistent in operation and to be adjustable from 2 to 25 seconds, to cater for varying types of drive, with a built-in fixed transition delay on change-over from star to delta. The starter to be suitable for a minimum of 15 starts per hour.

6.16 Auto-Transformer Motor Starters

6.16.1 Auto-transformer starters to be normally of the korndorffer connected type, floor mounted, and to comply with the applicable section of IEC 292-4.

6.16.2 Three triple pole contactors to be provided for line tapping and running, mechanically and/or electrically interlocked to ensure correct sequence of operation.

6.16.3 The contactor timing relay to be consistent in operation and to be adjustable from 2 to 25 seconds to cater for varying types of drive.

6.16.4 The auto-transformer to be class "C" insulated, air cooled, contained within the starter enclosure where practicable, arranged for korndorffer connection and provided with tappings to give

50%, 60% or 65% and 80% of full line to line volts.

Note:

Whatever the duty envisaged, the starter shall be capable of permitting two successive operating cycles, starting from the cold state, the time interval between two starts being equal to twice the starting time i.e. the length of time while the autotransformer carries current.

6.16.5 A thermostat to be fitted to the auto-transformer windings for protection against overheating. The thermostat to energize an integral visual and audible alarm, for a given period of time, after which the thermostat to trip the line contactor after tripping, due to overheating the starter to, lock out, until such time as the tripping device has been manually reset inside the starter enclosure.

- The alarm and trip settings and other pertinent details to be advised by the manufacturer/supplier.

- The starter to be suitable for 12 or 30 normal starts per hour. This shall be stated by the purchaser at inquiry stage.

6.17 Control

The starter shall be suitable for any of the following methods of control by simple re-arrangement of the internal control circuit and/or connections:

		METHOD				
6.17.1	**NON-AUTOMATIC 3 WIRE CONTROL**	**A**	**B**	**C**	**D**	**E**
	Local combined stop/thermal. overload reset push button	**X**	**X**	**X**	**X**	**X**
	Local start push button.	**X**	**X**	**X**	**X**	
	Remote stop push button.		**X**			
	Remote stop/start push button station.			**X**	**X**	**X**
	Local/off/remote "stay put". Selector switch (on starter).				**X**	

		METHOD		
6.17.2	**AUTOMATIC 2 WIRE CONTROL (WITH NON-AUTOMATIC METHOD FACILITIES)**	**F**	**G**	**H**
	Local thermal overload reset push button.	**X**	**X**	**X**
	Remote pilot switch (or sequence control switch).	**X**	**X**	**X**
	On/off "stay put" selector switch (on starter).		**X**	
	Hand/off/auto "stay put" selector switch (on starter).			**X**

6.17.3 The manually operated control devices forming part of the starter to be fitted on the front cover. The push buttons preferably to be dimensionally the same with identical fixings and interchangeable. Adjacent push buttons should not be capable of simultaneous operation.

6.17.4 The selector switches preferably to dimensionally the same with identical fixings and

interchangeable. Matching certified flush blanking-off plates or plugs should be available for purchase if for one reason or the other any of the control devices are removed.

The fitting of blanking-off plates, or the re-arrangement of the manual control devices, on the starter shall not invalidate the flameproof certification and weather protection. On-site driving of the enclosure is not permissible.

6.17.5 Remote control devices not physically part of the starter are normally the subject of a separate order. (refer to IPS-M-EL-185 for remote control stations).

6.17.6 If the inquiry does not specify a particular method of control then the starter shall be equipped and connected internally for control method A.

6.17.7 Stay put selector switches to be suitable for (key locking) in all positions to avoid unauthorized operation.

6.17.8 Starters initially equipped and connected for control methods F, G or H to be capable of conversion to any of the non-automatic 3 wire control methods by the removal of the local thermal overload reset push button and the substitution of a combined local stop/reset button and a local start push button.

Alternatively, the basic local start and stop/reset push buttons can be fitted to the front cover provided the stop button is suitably labeled and used for overload resetting only and the start button is mechanically capped and made electrically inoperative, (i.e. not connected).

6.17.9 If remote operation is employed, provision shall be made to render the start push button inoperative. - When remote operation is adopted, facilities in the form of link to be provided in the starter for operation from a remote unit such as a remote push button, float switch, pressure switch etc.

6.17.10 Push buttons shall comply with the requirements of IEC publication No. 337 and shall be located at a height not greater than 1750 mm above the floor level.

Note:

It must be possible to carry out normal maintenance such as replacement of contacts and operating coils without having to dismantle the starter unit.

6.18 Testing Supply

- Fuse protected switched socket shall be provided on motor starters, for their testing without energizing the main circuits.

- The rating of pertinent fuse shall be compatible for current required for testing of specific motor starter.

6.19 Nameplates and Labels

6.19.1 The nameplates, labels and their fixing materials shall be proven, durable under the service conditions specified for the motor starters in Attachment 1, they shall be corrosion and moisture resistant and provided with indelible inscription in the language specified in Attachment 8.

- Stainless nameplates and traffolite labels are acceptable.

- Holes for fixing of nameplate 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.

6.19.2 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 or trademark.

d) Type designation or serial number.

e) Rated operational voltages.

*** f)** Utilization category and rated operational currents (or rated powers), at the rated operational voltage of the starter.

g) Rated frequency, e.g.: 50 Hz.

h) If different from those of the coil: nature of current, rated frequency and rated control supply voltage.

If not evident from information stated elsewhere by the manufacturer, the following should also be stated on the starter nameplate:

i) Rated insulation voltage.

j) Rated thermal current.

*** k)** Rated making and breaking capacities. These indications may be replaced, if applicable, by rated duty with the indication of the class of utilization category.

l) Rated duty with the indication of the class of intermittent duty if any.

The following information concerning the operating coils of the starter shall be placed either on the coil or on the starter:

m) Either the indication "d.c." (or the symbol ===) or value of the rated frequency, e.g. : 50 Hz.

n) Rated coil voltage.

The following information shall be placed on the overload relay:

o) Type number: 1 or 2 (see Clauses 4.3.3 and 7.5.3.2.1 of IEC 292.1).

p) Current setting or setting range or an identifying mark according to Clause 4.3.3 of IEC 292.1. The information given shall make it possible for a user to obtain the time-current characteristics from the manufacturer, or from his catalogue, or from data supplied with the starter.

q) Dimensions of motor starter (height, width and depth.

r) Weight.

*** Notes:**

1) In case of nameplate(s) for star delta motor starter item "K" shall be deleted.

2) In case of nameplate(s) for auto transformer motor starters, the following amendments are required:

a) In item "f" the words "utilization category and" to be deleted.

b) Rated starting voltage(s), i.e. voltages at the apping terminal to be given.

7. INSPECTION, QUALITY CONTROL AND QUALITY RECORD

(See Attachment 2).

8. TEST AND CERTIFICATION

8.1 General Requirements for Test

(See Attachment 3).

8.2 Specific Requirements for Tests

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

1) TYPE TESTS

The manufacturer/supplier shall submit documentary evidence, or certificates of type tests showing compliance, where applicable, with the following IEC publications:

IEC 292.1	Clause	8.2
IEC 292.2	"	8.2
IEC 292.4	"	8.2
IEC 158.1	"	8.3
IEC 408	"	8.2

2) ROUTINE TESTS

Routine tests shall be carried out in compliance with the requirements of the following IEC publications:

IEC 292.1	Clause	8.3
IEC 292.2	"	8.3
IEC 292.4	"	8.3
IEC 158.1	"	8.3
IEC 408	"	8.3

Notes :

1) Electrical endurance tests of direct on line motor starter are considered as special test and is subject to agreement between manufacturer/supplier, and purchaser. (See IEC 292.1 Clause 8.4)

2) No special tests are required for star delta, and auto-transformer motor starters.

3) FINAL PHYSICAL CHECK

In addition to verification of type tests and witness of routine tests, the following checks shall be made before the shipment of motor starters.

a) The degree of ingress protection.

b) The effectiveness of reliability of operating mechanism of:

- Key locks
- Interlocks, and
- Transfer switches

c) Proper functioning of control devices.

d) The internal wiring and cabling for proper marking tightens and provision of contacts for remote control (where applicable).

e) The suitability of clamping, earthing termination and marking arrangement for incoming and outgoing cables.

f) Simulation of remote control operation where applicable.

g) Control of circuits of anti-condensation heater(s) of starter and motor (if any).

h) The soundness of instruments.

i) The correctness of circuit designation labels.

j) The completeness of data on name plate(s).

k) The presence of danger sign in visible places.

l) Verification of compliance of main and auxiliary circuits with the approved schematic circuit diagrams.

m) Fuse rating of individual circuits are correct and derated for site conditions.

n) That: There is required coordination between the motor starter and the short circuit protective device.

o) That: identical switching devices are interchageable.

p) That the body of motor starter is not damaged.

4) APPROVAL DOCUMENTS FOR EXPLOSION PROTECTION OF MOTOR STARTERS

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 3 of this Standard Specification, for both individual devices which make up the motor starter and for the motor starter as integrated unit.

Note:

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

a) Test results.

b) Certificates from Testing and Certifying Authorities .

c) Any instruction and precautions to be followed during erection and cable connection of motor starter.

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 outdoor environmental conditions given in Attachment 1.

9.2 The color of final layer shall be:

a) Light gray color No. 631 to BS 381 C or,

b) As specified in requisition.

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

10. INFORMATION FOR MANUFACTURER/SUPPLIER

The following information shall be given to manufacturer/supplier by the purchaser (where applicable):

10.1 Area Classification of Installation Site and Explosion Protection Code of Equipment

10.2 Location

Indoor or outdoor, fixed on ground or mounted on vehicle/ship.

10.3 Power Supply System

Voltage, phase, 3 or 4 wire, frequency, fault level neutral earthing system.

10.4 Type of Mounting

Floor or wall.

10.5 Type of Construction

Unit or cubicle.

10.6 Type of Starter

Direct on line, or star-delta, or auto-transformer.

10.7 Type of Access

With drawable or swing out or fixed.

10.8 Ingress Protection Required

10.9 Class of Duty, Utilization Category

10.10 Incoming Supply(s) to Motor Starter

a) By cable (Number of core, size and type) or,

b) By wire in conduit (Number wire type size and dia of conduit).

10.11 Details of Starter Unit

a) Rating (kW).

b) Composition (isolator fuse etc.).

c) Cable types and sizes (main and control).

d) Instruments.

e) Method of control (including whether local /on/off auto switch is required ?)

f) Type of overload protection (and whether hand or automatic reset is required ?)

g) Whether delayed under-voltage protection is required or facility for future connection is needed?

h) Type of indication on relay : Light emitting diodes (LED) or flag?

i) Whether earth fault protection is required.

j) Details of any special interlocking or auxiliary contacts.

k) Details of coil circuit voltage (if different from line voltage).

l) Details of remote control stations.

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

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 specification.

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

11.2 At Ordering Stage

Information ticked under heading of " certified information with order" in Appendix C.

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 DATA SHEET FOR MOTOR STARTER

-PROJECT NAME : ----------
-
-AREA CLASSIFICATION : (TO IEC 79.10)----------
-
Safe---------- zone 2 ----------zone 1 ----------
-
-EXPLOSION PROTECTION ----------
-IGNITION TEMPERATURE OF RELEASED GAS/VAPOR----------°C
-GROUP OF GAS IN SITE ----------
-
-TEMPERATURE CLASS OF EQUIPMENT ----------
-POWER SUPPLY IN SITE :
Voltage---------- phase---------- wire---------- frequency ----------
-
Fault level---------- neutral earthing ----------
-
-MOTOR STARTER TITLE : ----------
-
-TYPE OF MOUNTING :
Floor----------wall----------
-CONDITION FOR INSTALLATION :
Fixed on ground---------- fixed on vehicle or ship----------
-
Exposed to :
Shock----------vibration----------tilting----------etc.
-TYPE OF STARTER :
Direct on line----------star delta----------auto transformer ----------
-
-TYPE OF CONSTRUCTION :
Unit type ---------- cubicle type ----------
-
-FORM OF ACCESS :
With drawable ---------- swing out----------fixed ----------
-
-ENCLOSURE INGRESS PROTECTION :
For indoor installation ----------
-
For outdoor installation ----------
-

(to be continued)

APPENDIX A (continued)

-ANTI CONDENSATION HEATER SUPPLY FOR :

a) Motor starter ----------**b)** Motor ----------

-

-CLASS OF DUTY :----------

-

-UTILIZATION CATEGORY :----------

-

-INCOMING SUPPLY FROM :----------

-

a) By cable ---------- core ---------- mm^2 type ----------

or,

b) By---------- number ---------- mm^2 type--------- in ---------- mm dia conduit

c) Size and type of cable gland for case 'a'

-OUTGOING CABLE TO MOTOR :---------core ----------mm^2 type----------

-

size and type of cable gland:----------

-

AUXILIARY CABLE(S) FOR :

FUNCTION	No.	SIZE SQ. mm.	TYPE	CABLE GLAND
Remote control with or without ammeter				
Motor anti-condensation heater (where applicable)				
Extended alarm and orIndication				
PTCdetectors				
Control supply (whereapplicable)				

-DATA FOR CONDUIT ENTRY :

Number of entries and location on starter :----------

Size of 1.5 mm pitch conduit :

Tapped entry ---------- undrilled plate ----------

(to be continued)

APPENDIX A (continued)

Knock out ----------

Sealing materials for use with conduit entry in potentially explosive atmospheres:----------
---

-

-DETAILS OF MOTOR STARTER :

Rating----------

Composition:

Isolator, fuse, contactor:----------

-INSTRUMENTS :

Ammeter details----------

-METHOD OF CONTROL :

Method of control for which the starter has to be initially equipped and connected if other than method 'A' in Clause 6.17. (selection may be made from examples in Appendix D)

-Whether local /on /off auto-switch is required, and details of safety device:----------

-

-Method of control other than any one of those described in Clause 6.17:

For example programmable logic control----------

-

- Whether stayput feature is required:----------

-DETAILS OF REMOTE CONTROL STATIONS :

Start pushbutton---------- stop pushbutton----------

Ammeter----------

Indication light for motor stopped state----------

Indication light for motor running state----------

-PROTECTION DEVICES :

Overload protection----------

Earth fault protection----------

Adjustable time delayed under voltage protection.

-SPECIAL INTERLOCK :----------

-DETAILS OF CONTACTOR CIRCUIT VOLTAGE :

(if different from line voltage)----------

(to be continued)

APPENDIX A (continued)

-CURRENT TRANSFORMERS RATIO FOR :

Local ammeter----------

Remote ammeter----------

Protection----------

-SHORT CIRCUIT PROTECTION DEVICE :

H.B.C fuse for short circuit protection :

Location of 3 pole main H.B.C. fuse base :

a) Inside the enclosure: ----------

b) Outside the enclosure:----------

Details of main H.B.C fuse to be fitted to the above mentioned base:----------

- ADDITIONAL AUXILIARY CONTACTS ON SWITCHING DEVICE :

Name of SwitchingDevice	Type of contacts		Numberrequired		Purpose andbreaking capacity in Amps.
	a	b	a	b	
Isolator	Make N/O	Break N/C			
Line contactor	"	"			

-Pilot lamp assembly :

Number----------color---------purpose------Watt-------voltage-------direct-------through transformer--------

-PROVISION FOR PAD-LOCKING FACILITY :

For the manually operated isolating switch handle in the on position:----------

-WHETHER DELAYED RESTARTING RELAY IS REQUIRED----------

-WHETHER EARTH FAULT PROTECTION IS REQUIRED----------

(to be continued)

APPENDIX A (continued)

- DETAILS OF ANY SPECIAL INTERLOCKING OR AUXILIARY CONTACTS :

- DETAILS OF COIL CIRCUIT VOLTAGE :

(If different from line voltage)

- DETAILS OF MOTOR TO BE STARTED :

Maximum rating continuous----------

Number of poles----------

Design letter in kVA /kW with locked rotor (see IEC 34.12 for selection)

Full load current----------

Driven equipment----------

Run up time seconds----------

Power factor of motor----------

-DETAILS OF POWER FACTOR CORRECTION DEVICE ON MOTOR IF ANY :

Note :

The base operational current rating of the starter should not be less than 1.2 times the full load current of the motor, but the thermal overload heaters and H.B.C. fuses should be selected to suit the actual motor full load current.

APPENDIX B1

ADDITIONAL REQUIREMENTS FOR MOTOR STARTERS TO BE INSTALLED 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 Exe (EExe).

2. Components for cable glands, conduit fitting and stopping plugs shall be subject to BASEEFA or similar authority (U.L., P.T.B.).5. When single core wires through explosion proof conduit are connected to terminals of explosion proof equipment,

3. Ammeters, and selector switches, shall be located in flameproof chamber. With type of explosion protection Exd (EExd).

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 fitting 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.

*** Illustrations 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 B1 which follows.**

7. Prevention of condensation in potentially explosive atmosphere:

- Manufacturer/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 dimensions 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 explosionproof.

-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 opening constituting the vents.

Note:

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

(to be continued)

APPENDIX B1 (continued)

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

Explosion protection code----------

Standard No.----------

Certification No. and date ----------

Maximum voltage ----------

Maximum rating ----------

Type No.----------

Maximum permissible ambient temp. ----------°C

gas/vapor group

Maximum surface temperature of equipment ----------°C

Certification authority and mark:----------

Trade agent mark----------

Note:

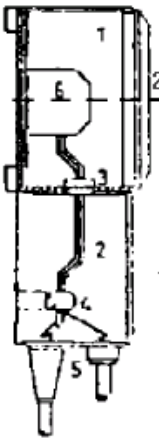
Requirements of Clause 6.19.2 of this Standard Specification shall also be implemented where applicable.

APPENDIX B2

CONNECTION OF EXPLOSION PROTECTED ELECTRICAL EQUIPMENT TO EXTERNAL CIRCUITS

(CABLE ENTRIES)

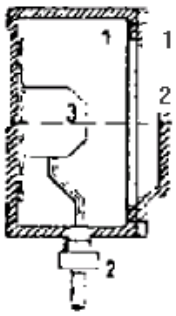
indirect cable entry
l.e.via EExe
(increased saftly)
terminal compartment



1 explasoinproof (flameproof) enclosure EExe
2 therminal compartment EExe (increased safty)
3 single core cable bushings between Exd comperment and (Ex) e compartment
4 (Ex)e terminal blocks for external connections
5 cable enclosure to the (Ex)ecompactment (compression glands of other glands)
6 electerical equipment

FIG 1

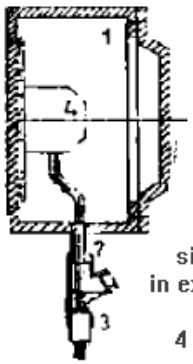
direct cable entry
using special glands



1 explasion proof (flameproof) enclosure
2 explasion proof (flameproof) cable entries (special glands) which together with the cables closeoff the explasion proof enclosure
3 electerical equipment

FIG 2

coduit system using
explasion proof pipes



1 explasion proof enclosure
2 explasion proof cable entry using single core wires run in explasion proofconduct
3 sealing filling
4 electrical equipment

FIG 3

APPENDIX C

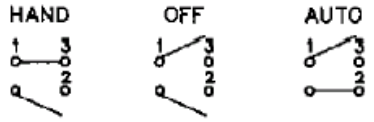
LIST OF DRAWINGS, DOCUMENTS, MANUALS, CERTIFICATES TOBESUBMITTED BY SUPPLIER IN NUMBERS AND THE TIMES INDICATED BELOW:

DESCRIPTION		REQUIRED WITH QUATATION	CERTIFIED INFORM. REQ. WITH ORDER			NUMBER OF WEEKS BEFORE DELIVERY
			N0. OF COPIES		NUMBER OF WEEKS AFTER ORDER	
			REPRO-DUCIBLES	PRINTED MATTER		
A	DRAWINGANDOTHEDOCUMENTS:					
	a)ELECTRICALEQUIPMENT:					
	1. DIMENSIONED OUTLINES AND FOUNDATION DETAILS					
	INCLUDING: CABLE ENTRIESANDCLEARANCES					
	2. DETAILS AND CROSS-SECTIONALARRANGEMET					
	3. MOUNTING DETAILS					
	4. PERFORMANCE DATA (TYPICAL)					
	5. PARTS / MATERIAL LIST					
	6. RELEVANTCATALOGUES					
	7. NAME PLATES					
	8. LIST OF FINAL LABELS					
	b) TERMINATION:					
	1. CONNECTION DIAGRAM					
	2.TERMINALBOXARRANGEMENT					
	3. CONNECTION AND TERMINAL DESIGNATION					
	c)ELECTRICALREFERENCE DOCUMENTS:					
	1. GENERAL DESCRIPTION					
	2.EQUIPMENTSPECIFICATION					
	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.PERFORMANCETEST, MATERIALS CERTIFICATES AND					
	CURVES					

APPENDIX D

TYPICAL EXAMPLES OF MOTOR REMOTE CONTROL STATIONS

SCHEMATIC DIAGRAMS



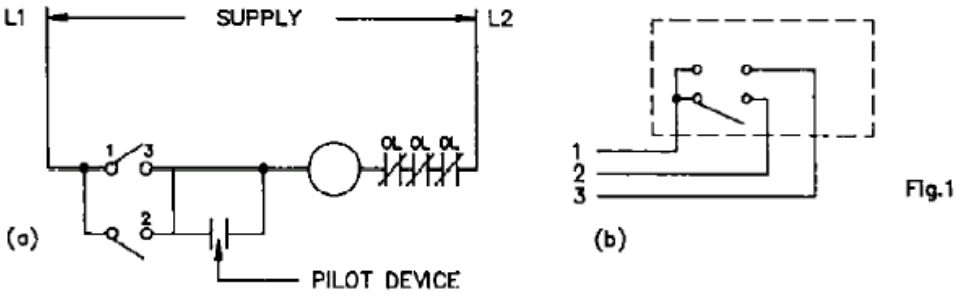


Fig.1

automatic control by pilot device maintained contact selector
3 position HAND- OFF- AUTO (subject to extreme safety pracaution)

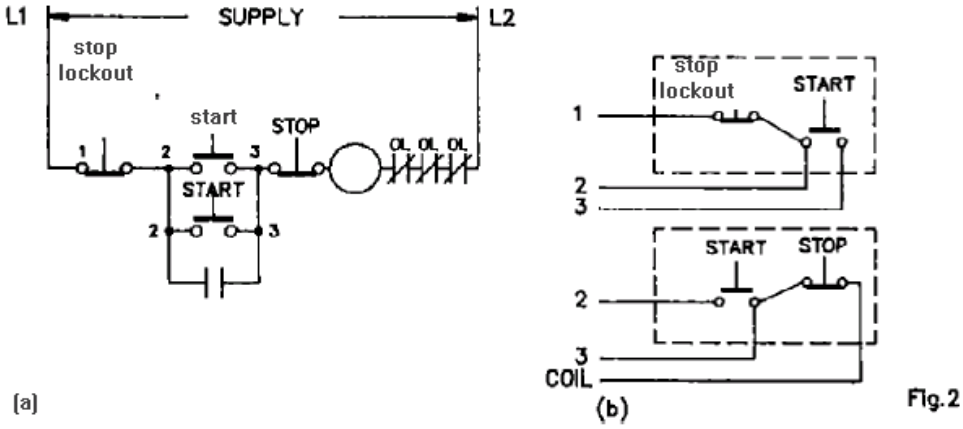


Fig.2

three wire momentary contact 2 separate stations

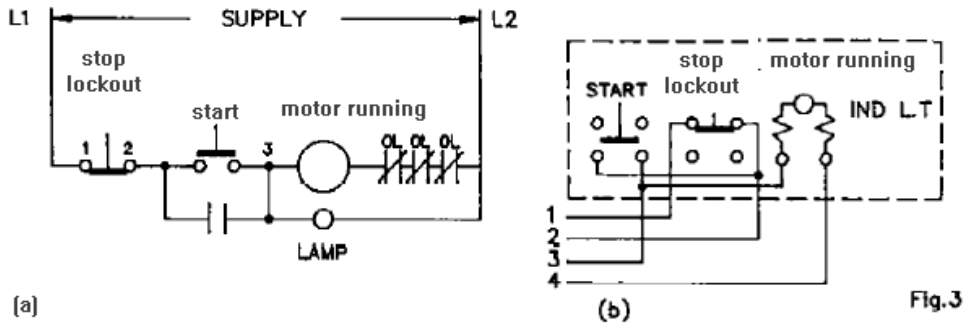


Fig.3

(to be continued)

APPENDIX D (continued)

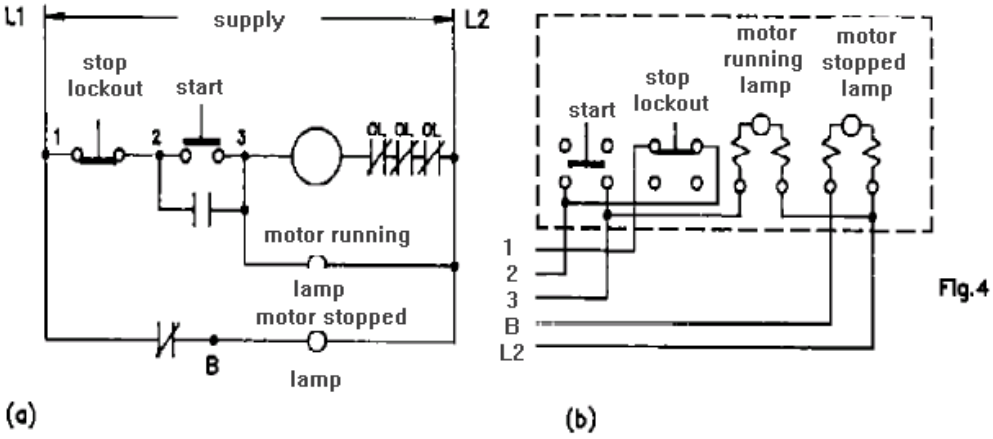


Fig.4

Motor Running Motor Stopped Indicating Momentary Contact ,

Extra N.C. Interlock on Starter

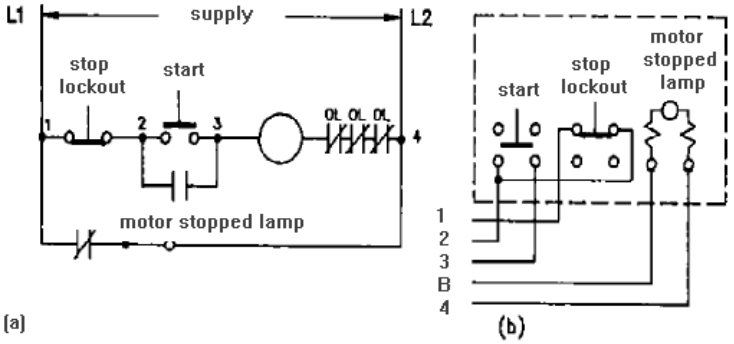


fig 5

motor stopped lamp momentary contact extra N.C interlock on starter

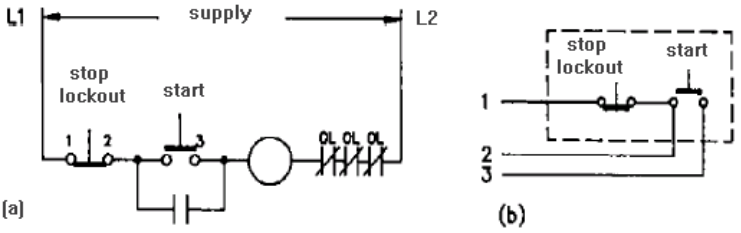


fig 6

three wire momentary cotact low voltage protection bosic diagrom

Note:

Provision shall be made for: PLC (Programmable Logic Control) when called for in data sheet.

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 time reach surface temperature of ----------degrees centigrade.

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

1.4 Relative humidity : ---------- percent.

1.5 Atmosphere: saliferrous, dusty, corrosive and subject to dust storms with concentration of 70 - 1412 mg/cubic meter, H_2S 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 starter(s) package shall be provided with a permanently attached readily visible identification tag(s) bearing the equipment number of the motor starter(s) 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 dismantling 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 RESPONSIBILITY 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 anydelay 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.		DESCRIP TION			
REFERENCE DRAWINGS					
D					
C					
B					
A					
REV	DATE	DESCRIP TION	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

INSTRUCTION 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 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 letter to be engraved into the white layer to give black lettering on a white background.

LETTER TYPE

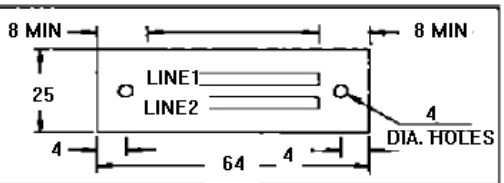
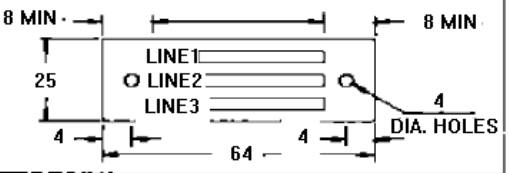
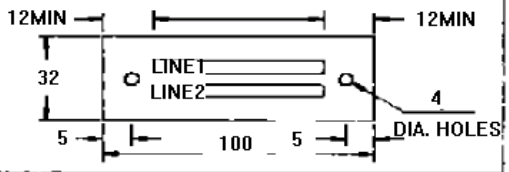
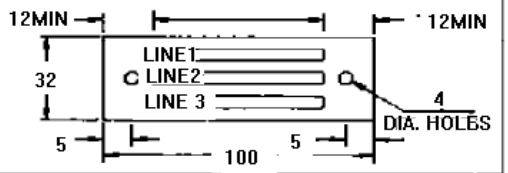
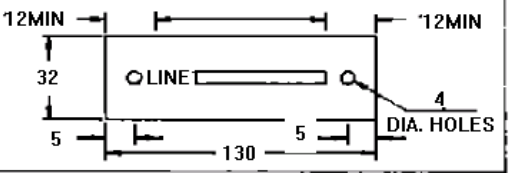
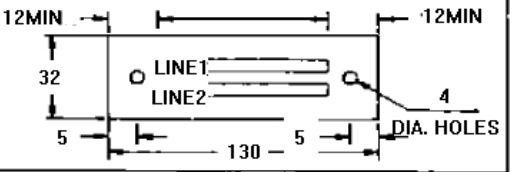
TYPE	HEIGHT	WIDTH mm	STROKE	CASE	LETTERS / 25 mm	SAMPLE
A	5	WIDE	LIGHT	UPPER CASE	7½ ± 1.2mm. TOL	ABCDEFGHIJKLM
B	5	WIDE	HEAVY	" "	7½ ± 1.2mm. TOL	
C	5	NARROW	LIGHT	" "	11 ± 2.5mm. TOL	
D	5	NARROW	HEAVY	" "	11 ± 2.5mm. TOL	
E	3	WIDE	LIGHT	" "	10 ± 1.2mm. TOL	
F	3	WIDE	HEAVY	" "	10 ± 1.2mm. TOL	
G	3	NARROW	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)

LAYOUT 1 LETTER TYPE	G E _F	LETTERS MAX/ LINE 28 19	
LAYOUT2 LETTER TYPE	G E _F	LETTERS MAX/ LINE 28 19	
LAYOUT3 LETTER TYPE	A _B C _D E _F G	LATTERS MAX/LINE 22 23 30 45	
LAYOUT4 LETTER TYPE	A _B C _D E _F G	LATTERS MAX/LINE 22 23 30 45	
LAYOUT5 LETTER TYPE	H J	LATTERS MAX/LINE 15 10	
LAYOUT6 LETTER TYPE	A _B C _D E _F G	LATTERS MAX/LINE 28 40 40 58	
LAYOUT7 LETTER TYPE	A _B C _D E _F G	LATTERS MAX/LINE 28 40 40 58	

All dimensions are given in mm.

Min = Minimum.

ATTACHMENT 14

FULL ADDRESS OF PURCHASER

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P.O.BOX No..... CODE No.....

TELEPHONE No.....

TELEX No.....

FACSIMILE No.....

Note:

Blanks to be filled by client.