MATERIAL AND EQUIPMENT STANDARD FOR
CONTROL PANELS AND SYSTEM CABINETS

FIRST REVISION
APRIL 2010

استاندارد کالا و تجهیزات
برای
تابلوهای کنترل و سیستم کابینت‌های ابزار دقیق

ویرایش اول
اردیبهشت 1389
FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS is based on internationally acceptable standards and includes selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable.

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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GENERAL DEFINITIONS:
Throughout this Standard the following definitions shall apply.

COMPANY:
Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER:
Means the "Company" where this standard is a part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract documents.

VENDOR AND SUPPLIER:
Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:
Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR:
Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR:
The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:
Is used where a provision is mandatory.

SHOULD:
Is used where a provision is advisory only.

WILL:
Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

MAY:
Is used where a provision is completely discretionary.
MATERIAL AND EQUIPMENT STANDARD
FOR
CONTROL PANELS AND SYSTEM CABINETS
ORIGINAL EDITION

FIRST REVISION
APRIL 2010

استاندارد کالا و تجهیزات
برای
تابلوهای کنترل و سیستم کابینتهای ابزار دقیق

ویرایش اول
اردیبهشت 1389

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1. SCOPE

This standard covers the general requirements for the material of control panels and system cabinets to be used in oil, gas, and petrochemical industries.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on April 2007, as amendment No. 1 by circular No. 312.

Note 2:

This bilingual standard is a revised version of the standard specification by the relevant technical committee on April 2010, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Note 3:

In case of conflict between Farsi and English languages, English language shall govern.

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 COMMISSION)

IEC 60068 "Environmental Testing Procedures"

Part 2 "Tests"

IEC 60068-2-1 Test A: "Cold"

IEC 60068-2-2 Test B "Dry Heat"

IEC 60068-2-42 Test Kc: "Sulfur Dioxide Tests for Contacts and Connections"

IEC 60068-2-1 Test A: "Cold"

IEC 60068-2-2 Test B "Dry Heat"

IEC 60068-2-42 Test Kc: "Sulfur Dioxide Tests for Contacts and Connections"
IEC 60068-2-78 Test Ca:
"Damp Heat, Steady State"

IEC 60079
"Electrical Apparatus for Explosive Gas Atmosphere"

Part 11
"Intrinsically Safe (i)"

IEC 60529
"Classification of Degrees of Protection Provided by Enclosures (IP Code)"

IEC 60605
"Equipment Reliability Testing"

IEC 60641
"Specification for Pressboard and Presspaper for Electrical Purposes"

IEC 60654 Part 1
"Definitions and General Requirements"

IEC 60654 Part 3
"Corrosive and Erosive Influences"

IEC 61000
"Electromagnetic Compatibility (EMC)"

IEC 61000-4-3
"Testing and Measurement Techniques - Radiated, Radio-Frequency, Electromagnetic Field Immunity Test"

ISA (INSTRUMENT SOCIETY OF AMERICA)
ANSI/ISA S 71-04 "Environmental Testing"

IPS (IRANIAN PETROLEUM STANDARDS)
IPS-I-IN-100(1)
"Inspection Standard for General Instrument Systems"

IPS-M-IN-120
"Material and Equipment Standard for Temperature Instruments"
3. CONFLICTING REQUIREMENTS

In the case of conflict between documents relating to the inquiry or order, the following priority of documents shall apply:
- First Priority: Purchase order and variations thereto.
- Second Priority: Data sheets and drawings.
- Third Priority: This Standard.

All conflicting requirements shall be referred to the Purchaser in writing. The Purchaser will issue confirmation document if needed for clarification.

4. UNITS

This standard is based on International System of Units (SI), as per IPS-E-GN-100 except where otherwise specified.

5. GENERAL

5.1 Each panel section shall be constructed as a self-contained unit so that after testing at the manufacturers’ works, the least number of connections are disturbed when the panel is shipped for shipment to site. Design details, layout and shape of panels shall be discussed and agreed with the Purchaser before drawings are submitted.

5.2 The panel layout shall be designed to follow the actual physical arrangement of the unit as closely as possible:

- a) Instruments shall be mounted in logical groupings according to their position in the process units, i.e., instruments needed for the area of control exercised by process operators

IPS-D-IN-116 "Standard Drawings"

IPS-E-IN-180 "Engineering Standard for Instruments Electrical Power Supply & Distribution System"

IPS-E-IN-190 "Engineering Standard for Transmission Systems"

IPS-G-IN-200 "General Standard for Instrument Air System"

IPS-G-IN-220 "Engineering and Installation Standard for Control Centers"

IPS-E-GN-100 "Engineering Standards for Units"

IPS-E-IN-180 "IP Standard for Control Centers"

IPS-G-IN-200 "Engineering Standard for Instrument Air System"

IPS-G-IN-220 "Engineering and Installation Standard for Control Centers"

IPS-E-GN-100 "Engineering Standards for Units"

IPS-D-IN-116 "Standard Drawings"

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IPS-G-IN-220 "Engineering and Installation Standard for Control Centers"

IPS-E-GN-100 "Engineering Standards for Units"

IPS-D-IN-116 "Standard Drawings"
shall be grouped together. A clear demarcation shall be made on the panel between process units. Each unit shall be identified by a nameplate mounted in the top section of the panel.

b) As a secondary criterion instruments shall occupy relative positions in accordance with the natural expectations of the operator, i.e., related variables shall be adjacent, (e.g. cascade controllers). Expected sequences as of process items or of position within a process item, should be adjacent.

c) Panel mounted multipoint temperature indicators shall be mounted on a vertical section of the main panel.

5.3 An identification system, such as tag numbers, color codes or symbols, which will enable an operator to quickly identify any particular equipment, shall be used in the mimic panel layout.

5.4 The space behind and at each end of a freestanding panel assembly shall form an unobstructed passageway of 1500 mm taking into account any equipment mounted on the back wall. Similarly the walkway inside a walk-through type shall be not less than 1200 mm.

5.5 The instrument arrangement and mounting heights on the panel shall be subject to the Purchaser approval.

5.6 In general the maximum and minimum instrument mounting heights shall be as follows:

a) Minimum: To centerline of instruments requiring operation or manipulation (e.g., pushbuttons or controllers) 685 mm.

b) Maximum: To centerline of instruments requiring operation or manipulation (e.g., pushbuttons or controllers) 1600 mm.

c) Maximum: To centerline of instruments requiring inspection but not operation in normal use (i.e., Receiver gages) 1980 mm.

5.7 Items such as annunciators may be mounted above other instruments, but care must be taken that legends on annunciators are clearly readable in spite of their mounting height. In any case test acknowledgment buttons for annunciators are subject to the same mounting height rules as for
instruments requiring manipulation during normal plant operation.

5.8 Panels should normally be free standing and console type may be used with prior consent of the user. In all cases they shall conform to the purchaser standard drawings.

5.9 The control panel shall be facial type with miniature or large case instruments, or both, mounted in horizontal and vertical rows.

5.10 The distance between rows of instruments will depend upon the types of instrument and the accessibility for maintenance and adjustment. See IPS-G-IN-220(1), Fig.

5.11 The individual indicating lights, annunciator systems and miscellaneous indicators shall be mounted above the top row of the instruments and shall conform to the purchaser standard drawings:

a) The alarm indicators shall be located in the panel section containing the associated instrumentation. They shall be mounted above the process instruments in a matrix array, but no single array should exceed seven indicators in any horizontal row or five indicators in any vertical row.

b) Indicating lights not associated with process alarms shall be segregated from process alarms.

5.12 Mimic presentation (semi graphic) of the main process flow diagrams is acceptable, but full graphic presentation is not recommended.

Note:
Where a graphic display is required, the execution may be such that the layout can be easily modified on the site, i.e. by means of small removable and replaceable building blocks. The detailed execution shall be as indicated in the requisition and the drawings attached or referred there to.

5.13 The total width of the panel shall be determined by the type and number of instruments used. Groups of panels shall present a smooth unbroken surface.

5.14 On new process plant installations, at least 20% usable spare panel space shall be provided.
This spare space should normally be distributed over the panel. In some cases it may be logical to provide spare blank panel space at the end of the group of panels.

5.15 Free space shall be available, at the back of the spare blank panel for future expansion.

5.16 Auxiliary equipment installed in prewired and pre piped panels shall be accessible for maintenance and adjustments.

5.17 All wiring, piping, etc. shall be adequately marked, coded or colored so that it can be easily identified.

5.18 All instruments on the face of the control panel shall be flush-mounted.

5.19 ESD switches shall be guarded from accidental operation.

5.20 Illumination levels on control panels, and desks, shall be in accordance with electrical part of IPS standards IPS-E-EL-100 "Lighting and Wiring". Adequate illumination shall be provided at the rear of the panel. See also: IPS-G-IN-220(1), paragraph 6.2.3.

5.21 Panels that are totally enclosed shall have access doors with quick release fastenings.

5.22 The panel assemblies shall be tested before erection wherever possible.

5.23 Console type panels will normally be free standing cabinet type enclosures, incorporating a desk or sloping area on the front of the cabinets.

5.24 Instruments on consoles shall be prewired and pre piped and shall be completely enclosed.

5.25 If maximum ambient temperature conditions are such that apparatus manufacturer’s recommended operating temperatures could be exceeded, provisions for environmental control shall be agreed with the purchaser.

6. LABELING AND NAMEPLATES

6.1 Panels shall be clearly labeled with plant instrument numbers and duties at the front and rear.
6.2 Labels shall be transparent plastic material and engraved on reverse side. The engraving to be filled in either black or white depending on which is most legible. Provision shall be made in the panel mounted instruments, for insertion and removal of meter constant cards and control valve action.

6.3 The material for name-plates should normally be a laminated bicolor plastic, which when engraved, the top layer is cut through allowing the letter to show in the second color.

6.4 Continuous panels for control of a number of process units, as in the case of integrated plant, shall have the panel sections clearly defined by arrow-headed lines and labeled with the plant designation at the top of the panel.

7. CONTROL PANELS

7.1 Panel layout for control houses shall permit the operator or operators to observe the functioning of all instruments from a central control point.

7.2 It is desirable that each operator be provided with a strategically positioned writing desk.

7.3 Instruments which are required for assessment of plant behavior shall be mounted in such a manner as to be readable from the control desk. Presentation may be in digital or analogue form.

7.4 Consideration may be given to providing common recording points with facilities for connection to a range of instruments measuring process variables. These systems, when connected into controller transmission loops, must be designed so that the reliability of the controller is not affected, and affects from switching transients are avoided.

7.5 Instruments shall in general be of the "miniature" type, ("Miniature" applies to instruments approximately 144 mm × 144 mm or smaller), and for smaller size shall be confirmed by company / client.

7.6 The instalation height of instruments shall be in accordance with the standard drawings IPS-D-IN-116

6-7 برصب‌ها یا آباداز جنس پلاستیک شفاف بوده ومی‌سپری می‌شود به‌طور کلی، نشان دهنده و نوع سفید گرمی کدام خوانایی باید بر هم سایه یا نظیره گرمی، گرد شود. جهت تجربیات ابزار دقیق قص نشان دهنده روز تابلویی، باید محض‌هایه برای گذشتن و برداشتن کارنامه‌های نشان دهنده طبیعی‌گیر و نوع بستر کنترل در نظر گرفته شود.

7-6 جنس بلاک مشخصات معمولیً برای پلاستیک دو رنگ لایه‌ای باید، وقیتی که حک شد، لایه بالاتی بیرده شده، اجازه می‌دهد که رنگ دوم نشان داده شود.

7-5 تابلوهای میلی‌واژه برای کنترل تعادلی از واحدهای فراپایندی، اندازه‌ها و بی‌کاری، باید دارای فلزات تابلویی که چتر و خوراکی با خطوط جهت‌دار تعیینی شده و برچسب عنوان واحد در یکی تابلو قرار داده شده است، باشد.

7-7 تابلوهای کنترل

7-6 یکی از تابلوی برای واحدهای کنترل باید به آبی‌ور با ابزارهای ان با به‌دست آمده که تمام تجربیات ابزار دقیق در حال کار را از مرکز کنترل ببیند.

7-7 شایسته است که هر ابزار می‌تواند مناسب شغل خود را داشته باشد.

7-4 جهت تجربیات ابزار دقیق که جهت تشخیص وضعیت واحد لازم است، بازه طویل و نصب شده باید که از میز کنترل قابل خواندن باشد. نمایش ممکن است در فرم دیجیتال یا آنالوگ باشد.

7-7 ممکن است ملاحظاتی برای ایجاد نقاط ثابت مشترک با وضعیت جهت اتصال به برخی از تجربیات ابزار دقیق که تغییرات فرایندی را انتقال‌های مکنرد، در نظر گرفته شود. این سیستم‌ها وقتی که به حفظه‌های انتقال‌های کنترل کندن وصل می‌شوند، بازه طویل و نصب شود که بر قابلیت اطمینان کنترل کننده تأثیرگذار نباید و از اثرات گذرا کلیدزی جلوگیری شود.

7-7 آب‌ربا هم‌پیوسته ابزار دقیق معمولاً با آباداز نوع مینیاتوری باشد. (مینیاتور) به تجهیزاتی که می‌شود که نظیره‌گیر و 144 در 144 میلی‌مرن یا کوچکتر باشد، و اندازه کوچکتر باشد با توافق شرکت یا کارگرفته‌ها باشد.

7-7 ارتفاع سبب اختلافات ابزار دقیق بازیمکت نقشه‌های استاندارد IPS-D-IN-116 باشد.
8. CONSOLE TYPE PANELS

8.1 Instruments shall be grouped on inclined and/or vertical panels. A desk shall be provided as an integral part of the panel structure.

8.2 The detailed design and quality of the consoles shall be such that they can withstand normal handling during transport.

8.3 Sectional construction should be selected to facilitate manufacturing, handling and transportation.

8.4 Openings such as tube connections etc. shall be covered to avoid entry of dust.

8.5 To enable easy reassembling of the sections on site, the wiring and the tubing to be reconnected shall be properly identified. All instruments and components packed separately from the console shall also be properly identified.

8.6 A small quantity of components e.g., ferrules, nuts, tubes, terminals and wires shall be supplied with the console, for on site assembling and small modifications.

9. INSTRUMENT PANELS - MIMIC PROCESS FLOW DIAGRAMS

9.1 Mimic diagrams, either drawn or built-up, shall be mounted immediately above conventional and free standing panels and may be inclined forward at an angle of 15 degrees, if specified in data sheet.

9.2 A semi-graphic representation shall be provided in accordance with plant process and utilities flow. Main process lines shall be 5 mm and instrument lines shall be 3 mm.

9.3 Generally fabrication by means of tiles for indoor panels are in preference as rearrangement and modification can be more conveniently carried out.

9.4 Towers, drums, vessels and similar major items of equipment shall be included in the diagram. Pumps, compressors, heat exchangers and other such items of equipment shall only be shown when control or measuring instruments are directly connected to them or to improve understanding of the process.

8 - 8 تابلوهای ایزاردقیق
8 - 8 تجهیزات ایزاردقیق باید در تابلوهای مابیل و یا عمومی گرده بندی شده باشند. یک میز تحریر باید جزو ساختار تابلو باشد.
8 - 8 ژنتات طراحی و کینگ فکسولها باید طوری باشد که تحمیل جاجایی معمولی در حین حمل و نقل را داشته باشد.
8 - 8 چهار سهولت ساخت، جاجایی و حمل و نقل ساختار قطعه قطعه باید انتخاب شود.

4 - 8 قسمتهایی از ورود گرد و خاک بوشیده شده باشند.
5 - 8 جهت تابلیت دوره ی سوار کردن آسان قطعات در محل، سیم کتی و نایب بندی دوره ی باید بطور مناسب منظور گردد. کلیه تجهیزات ایزاردقیق و قطعات کنسول باید بطور جدایگانه و مناسب بسته بندی و مشخص گردد.
6 - 8 چهار نصب تابلو در محل، باید مقدار کمی از قطعات، از جمله اجراهای فلزی، مهره، نایب، ترمینال و سیم همراه با کنسول داده شود.

9 - 9 تابلوهای ایزاردقیق - نقشه‌های جریان فرآیندی میمیک

1 - 9 نوشته‌های میمیک، کشیده شده پای ساخته شده، باید بدن فاصله در بالای تابلوهای متناول و تابلوهای خود ایستا نصب شده باشد. اگر مایل بندی جلو در زاویه ۱۵ درجه اگر در داده بگر مشخص شده باشد، نصب گردد.
2 - 9 نمايش نیمه گرافیک باید متقاطع فرآیند واحده و نقشه سروسیس (اجابه آب، برق، خار، طراحی) تهیه گردد. خطوط فرآیند اصلی باید ۵ میلی مت و خطوط ایزاردقیق باید ۳ میلی مت باشد.
3 - 9 معمولاً برای ساخت تابلوهای داخلی با قطعات موزاییکی تریج داده می‌شود که در اصلاح و آراش مجدد، نیاز برا راحتی بیشتر آن را انجام داد.
4 - 9 برچا، مخازن، ظروف و اقلام تجهیزات اصلی مشابه باید در نقشه نگاه داده شود. بپیمای، کامپیوترها، میلی‌های جراین و سایر اقلام تجهیزات مشابه باید وقتی نشان داده شوند که تجهیزات اندازه‌گیری که مکمل مستقیماً در جهت بهتر شناختن فرآیند بی آنها وصل شده باشد.
9.5 Constructional details of towers, vessels and heaters shall not be shown unless required for location of instrument connections.

9.6 Major equipment symbols shall be scaled from actual dimensions where possible.

9.7 Instrument symbols shall be mounted external to process lines and vessels, and as far as possible, in the same relative position as their associated panel mounted instruments.

9.8 Instrument symbols shall be shown connected with all relevant instrument measurement, transmission, and control lines.

9.9 Where process lines cross, the horizontal line shall be continuous, and the vertical line broken. In all cases instrument lines shall be broken where they cross a process line.

9.10 Equipment symbols shall be marked with both name and number.

9.11 Instrument symbols shall be marked with the process instrument tag number.

9.12 Plant feed and products lines shall be provided with in-line labels marked with the name of the process fluid.

9.13 Process lines shall be provided with arrow heads to depict direction of flow.

9.14 Instrument lines shall, where necessary, be provided with arrow heads to illustrate cascade connections.

9.15 Equipment and instrument symbols, lines, and nameplates, shall be manufactured from materials which will ensure freedom from buckling with temperature changes.

9.16 Symbols, lines and labels shall be fixed to the panel by means of an adhesive which will allow for their removal with or without the application of a solvent and without damaging the painted surface of the main panel.

9.17 Mimic diagrams should be colored in accordance with the following color code:

a) Main panel- semi-matt admiralty Grey to RAL 7031 (BS-381C 697).

5-9) 4-9) 3-9) 2-9) 1-9) 0-9) 9 -9) 8 -9) 7 -9) 6 -9) 5 -9) 4 -9) 3 -9) 2 -9) 1 -9) 0 -9)

-9) Equipment compliance and nameplates, shall be manufactured from materials which will ensure freedom from buckling with temperature changes.

-9) Symbols, lines and labels shall be fixed to the panel by means of an adhesive which will allow for their removal with or without the application of a solvent and without damaging the painted surface of the main panel.

-9) Mimic diagrams should be colored in accordance with the following color code:

a) Main panel- semi-matt admiralty Grey to RAL 7031 (BS-381C 697).

-9) Plant feed and products lines shall be provided with in-line labels marked with the name of the process fluid.

-9) Process lines shall be provided with arrow heads to depict direction of flow.

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-9) Process lines shall be provided with arrow heads to depict direction of flow.

-9) Instrument lines shall, where necessary, be provided with arrow heads to illustrate cascade connections.

9.10 Equipment symbols shall be marked with both name and number.

9.11 Instrument symbols shall be marked with the process instrument tag number.

9.12 Plant feed and products lines shall be provided with in-line labels marked with the name of the process fluid.

9.13 Process lines shall be provided with arrow heads to depict direction of flow.
b) Equipment symbols, towers, vessels, etc.,-semi-matt Dark Grey to RAL 7021 (BS-381C 632).

c) Instrument symbols, and control valves-semi-matt Black to RAL 7021.

d) Instrument measurement, transmission and control lines- semi-matt Black to RAL 7021.

e) Water- matt pale rounded Blue to (BS-381C 172).

f) Steam-semi-matt signal Red to RAL 3001 (BS-381C 537).

g) Process Air-semi-matt White to RAL 9010.

h) Hydrocarbon vapor and gas-semi-matt Lemon to (BS-381C 355).

i) Hydrocarbon liquids-Light buff to (BS-381C 358), Traffic yellow to RAL 1023 (BS-381C 356) and Golden Brown to RAL 8024 (BS-381C 414); to distinguish, respectively, light medium and heavy streams.

j) Chemicals and corrosive fluids- semi-matt Light Brunswick Green to RAL 6027 (BS-381C 225).

9.18 A color code key shall be shown at one end of the mimic diagram panel.

10. PAINTING OF INSTRUMENTS AND PANELS

10.1 The surface of panels except the inner surfaces, for which items c, d and e (noted under) are not required, shall be prepared and painted with air-drying materials in accordance with the following procedure:

a) Surfaces of the finished panel shall be blast cleaned and given one coat of etches primer, except that zinc coated sheet shall be degreased and not blast cleaned.

b) One coat of gray primer shall be applied.

c) Any indentations shall be filled with quick drying putty in thin layers.

10-1 رنگ آمیزی تجهیزات ابزار دقیق و تابلوها

ا) سطوح تمام شده تابلوها باید با فشار یک پوشش با اسید اولیه داده، بیج فلز روی اندود شده که باید از جنب یک پوشش تابی با فشار هوا تمیز نمود.

ب) یک پوشش اولیه خاکستری باید استفاده شود.

ج) دندانها را باید با لایهای تازی پننه سریع خشک شونده پر کرد.
d) Two coats of dry cutting knife filler shall be applied and allowed to dry overnight before flattening.

e) The undercoat shall consist of one coat of synthetic enamel ground coat.

f) The finish shall be one coat of synthetic enamel, semi-matt or eggshell, color RAL 6004 Sea Green except that mimic diagram panels shall be Admiralty Gray to RAL 7031 (BS-381C 697) semi-matt or eggshell.

10.2 Instruments shall be painted light Brunswick green to RAL 6027 (BS-381C 225).

10.3 Any deviation from the colors of panels and instruments shall be subject to the user approval.

11. PANEL CONSTRUCTION

11.1 Fabricate the control panel from 3 mm (minimum) cold rolled steel formed members except for the 100 mm channel base frame.

11.2 Panel structure shall be entirely self-supporting by the use of 50 mm structural angle iron frame. Framing and brackets shall be as necessary to achieve a rugged design and to insure a smooth, flat surface with a maximum deflection of 4 mm over total surface of panel after installation of all instruments and accessory equipment. Design and fabricate panel lengths from a smooth, continuous panel surface. Provide holes at panel joints complete with bolts, nuts, and washers for panel assembly, shop-assemble the entire unit and check for accurate alignment and surface matching.

- Provide removable end side plates.

- Bottom and rear of the panel shall be easily accessible.

11.3 The top section of the panel board shall be a medium density semi-graphic display for each panel unit.

11.4 For handling purposes, each shipping section shall be provided with removable lifting lugs designed for lifting without deforming the panel.

11.5 Cut outs for instruments must be within the
11.6 Where cut outs are specified for future instruments they shall be covered by 3 mm steel removable plates, finished and painted the same as the front of the panel.

11.7 All burrs produced around cut outs or bolt hole drillings must be ground smooth.

11.8 The rear panel area shall not be obstructed by conduits, ducts, raceways, stiffeners, etc.

11.9 Filler panels, when specified, shall be designed and furnished for bolting to the panel. They shall be fabricated from 3-4 millimeters cold-rolled steel plate with 50 mm turn back, corners are welded and ground smooth. The filler panels shall be finished to match the panel color.

12. ENCLOSED PANELS FOR HAZARDOUS AND NON-HAZARDOUS AREA CLASSIFICATIONS OUTDOOR & INDOOR LOCATIONS

12.1 Construction of panel shall be fully enclosed. Face plate with remaining general structure shall be 3 mm steel minimum. The base shall consist of 100 mm high channel iron. Doors and access plates shall be 1 mm steel minimum. Doors shall be finished to match the panel color.

12.2 Painting and nameplates shall be as mentioned before. See section 10.

12.3 Panels located in Hazardous Area shall be designed, fabricated and tested as per relevant protection standards, IEC 60529.

13. ELECTRICAL INSTALLATION

13.1 The panel board will be installed in an air-conditioned pressurized control house classified as non-hazardous, suitable for general purpose electrical devices and wiring. All components and wiring must conform to the requirements of the electrical codes. Ratings, construction and testing, are in accordance with the applicable tolerances as specified by their manufacturer.

13.2 Where cut outs of future instruments may be specified they shall be be provided by 3 mm steel removable plates, finished and painted the same as the front of the panel.

13.3 All burrs produced around cut outs or bolt holes must be ground smooth.

13.4 The rear panel area shall not be obstructed by conduits, ducts, raceways, stiffeners, etc.

13.5 Filler panels, when specified, shall be designed and furnished for bolting to the panel. They shall be fabricated from 3-4 millimeters cold-rolled steel plate with 50 mm turn back, corners are welded and ground smooth. The filler panels shall be finished to match the panel color.

13.6 Painting and nameplates shall be as mentioned before. See section 10.

13.7 Panels located in Hazardous Area shall be designed, fabricated and tested as per relevant protection standards, IEC 60529.

13.8 Air-conditioned pressurized control house classified as non-hazardous, suitable for general purpose electrical devices and wiring. All components and wiring must conform to the requirements of the electrical codes. Ratings, construction and testing, are in accordance with the applicable tolerances as specified by their manufacturer.
standards. All devices must be approved by UL, or other equivalent establishments except those categories for which no approval list has been established and these must be approved by the Purchaser. The edition of codes, standards and approval lists, current at the time when specification is issued for purchase, shall be applicable.

13.2 Fabricator shall provide the wiring for all internal wiring of the panel.

13.3 Vertical raceways preferably shall be 100 mm wide. Separate raceways shall be provided within the panel for isolation of each of the following types of instruments wiring systems:

a) Thermocouple extension wire.
b) DC signals (4 - 20 mA).
c) AC power and control wiring, with more than 24 V DC.
d) Pulse signals.
e) Intrinsically Safe Signal (see paragraph 15.5.5).
f) Bus

13.4 When common terminal boxes are used, these terminal boxes shall be divided into sections separated by a metal barrier so as to segregate the following types of signals:

a) 4-20 mA DC instruments signals.
b) Thermocouple signals.
c) AC power and control system wiring, with more than 24 V DC.
d) Pulse signals.
e) Intrinsically Safe signal in accordance with IEC 60079-11.

13.5 Terminal blocks for instruments and control wiring shall be medium duty, 300 to 600 volt rating, and barrier type, of non-hygroscopic material. Terminal blocks to be approved by the Purchaser.

13.6 Terminal blocks shall be mounted on rails with a minimum of 25 mm spacers between the

BAID TOWLOSS AINJEME UL BAY MOWSSAT MIRBATOSHE DEEGAR YZ MOWARDEY KHE FERHST SHDE YARY AERHEYE KAH AHTIBAYEH BI GOWAHIMAGE NADERD AND YARD TOWLOSS XIRDAR TAILID GRENDE, GAOWA SHDE BAASH. WRAISH KEDDA, ASETARIJDAH AND FERHSTAYE GOWAHYE JARIJY DIZ MIZAM SODOR KHE BERK.

MESHAXAT BYRAI XIRDAR SADAR ME, BAID QALIL AGERA BAASH.
rail and the mounting surface. Separation between the rows of terminal blocks shall be a minimum of 80 mm for terminal blocks up to 600 mm long. Separation shall be 150 mm for longer rows.

13.7 Each terminal on panel mounted electrical devices (such as push-button switches, indicating lights, relays, ammeters, etc.) shall be wired to a terminal block by the panel fabricator. These terminal blocks shall be provided with protective covers.

13.8 All panel board wiring (with the exception of thermocouple extension wire) shall be terminated with lugs at both ends. These lugs shall be crimp-on, vinyl self-insulating, locking type. All wires shall be identified with instrument tag number and terminal designation at both ends with heat shrink markers.

13.9 Terminal block spare terminals shall be provided according to the following:

<table>
<thead>
<tr>
<th>REQUIRED</th>
<th>ADDITIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TERMINALS</td>
<td>SPARES</td>
</tr>
<tr>
<td>2-4</td>
<td>2</td>
</tr>
<tr>
<td>5-10</td>
<td>4</td>
</tr>
<tr>
<td>11-20</td>
<td>8</td>
</tr>
<tr>
<td>21-30</td>
<td>10</td>
</tr>
<tr>
<td>31-40</td>
<td>12</td>
</tr>
<tr>
<td>41-90</td>
<td>18</td>
</tr>
</tbody>
</table>

For more than 90, 20% spare shall be provided.

13.10 Terminal blocks shall be provided on panels and subassemblies for power supply wiring, alarm system wiring, and electrical transmission lines. No terminal blocks are permitted for neither thermocouple extension wiring, nor for analytical instruments signal lines. The signal lines for these instruments shall be directly connected to the receiving instrument. The terminal blocks shall be clearly identified with engraved or embossed numbers.

13.11 The electrical supply to the instrument panel shall be 24 V DC or 110 volts 50 Hz two wire, grounded, single phase. For other power supplies, see Appendix A.

13.12 Normally PVC trunk type or sheet metal wire ways, rigid or flexible conduit, or combination of these should be used. When area
classification permits, PVC insulated wires on adequate trays may be used.

13.13 Disconnect switches shall be provided for servicing requirements of all panel instruments. One disconnect switch may be used to serve as many as six chart drives. For electronic instruments, cabinet type annunciators with multiple alarm units, potentiometers and emergency shut down solenoid valves and relays, one disconnect switch shall be used per instrument. Each disconnect switch shall be clearly labeled to identify the particular instruments or alarm units served by that switch. For more details see also: IPS-E-IN-180, "Electrical Power Supply & Distribution System".

13.14 Isolation possibilities for supplies to individual instruments shall be available, e.g., by means of dedicated power distribution fuse/socket boxes or fused terminals.

13.15 Low Voltage DC Wiring

a) Wiring shall be stranded tinned copper, color coded. Installation shall be in separate conduit or slotted plastic duct with 30% spare space provided.

For more details see paragraph 15.5.

13.16 AC Wiring

AC wiring shall be 2.5 mm², stranded tinned copper, twisted pair, color coded, and 600 volt rating insulation.

14. AIR SUPPLY TO PNEUMATIC PANELS

14.1 The instrument air header shall run the full length of the panel, and shall be constructed of brass pipe and fittings, cadmium plated. Brass unions shall be supplied between panel sections.

14.2 The dual-air regulator filter station shall be supplied with 3-way brass cocks connected to allow either regulator or filter to be used to supply air to the header. These stations shall be such as to permit removal of the filter cartridges without disassembly of piping, and to permit disassembly of either regulator/filter without interfering with the operation of the other unit, as well as to permit removal of the filter cartridges 600 volt rating insulation.

14.16 AC Wiring

IPS-M-IN-220(1)
provide cock handles attached to the cocks.

For more information, reference to be made to:

IPS-G-IN-200 "Instrument Air System".

14.3 Where each panel instrument has its own pressure reducing regulator and filter set, the header shall be of galvanized steel pipe.

14.4 For future expansion, spare valve take-off connections shall be provided on the air header. The spare connections shall not be less than 20% of the existing take-offs.

14.5 For long curved panels, in order to facilitate field connection, the header shall be joined between panel sections with a flange or union type connection.

14.6 A drain valve shall be provided at the bottom end of the header, farthest from the air supply source.

14.7 Control and transmission lines and interconnecting lines between panels and subassemblies shall be brought to bulkhead fittings. The bulkhead fittings shall be installed on top of the panel. The bulkhead fittings shall be adequate for connecting the tubing from the field.3

14.8 When PVC multi tubing is used for connecting field instruments to the control instruments, the bulkhead fitting shall be mounted vertically and housed in a detachable enclosed junction box. The junction box shall be freely installed on top of panel.

14.9 When copper tubing is used for connecting field instruments to the control room instruments, the bulkhead fittings shall be mounted vertically.

14.10 Each bulkhead connection shall be clearly labeled with the designation of the particular instrument or connection it serves.

14.11 Testing of the air supply header and signal tubing shall be accomplished with air. Each joint shall be tested with a soap and water solution and shall be absolutely tight. Instruments shall also be tested in the manner prescribed by their manufacturer. For testing refer to IPS-I-IN-100, "Inspection Standard for General Instrument Systems".

14.12 The relief valve and pressure gage on the air header shall be constructed of brass, bronze,
14.13 Unless otherwise shown on the panel drawings, all pneumatic tubing shall be copper, PVC coated, ¼" O.D. by 0.8 mm wall thickness as minimum.

14.14 Tubing fittings shall be compression type of purchaser approved manufacturer.

14.15 All tubing shall be clamped or supported from the panel frame-work as required to prevent sagging. No clamps or supports shall be attached to the instruments.

14.16 Tubing runs shall be horizontal or vertical with each 90 degree bend. Tubing bends shall be rigidly held to limit the tubing bending radius to 15 mm min.

14.17 Tubing runs shall be arranged so that visual tracing is possible, and finger tracing will not be required.

14.18 The panel fabricator shall supply a bulkhead plate as shown on the panel drawings, fitted with bulkhead fittings, and 10 spare bulkhead fittings and locations shall be provided. Fittings shall be suitable for connection of copper tubing of panel to plastic tubing of field incoming tubes.

14.19 Tubing shall be installed separately from wiring, in PVC ducting with a cover.

15. SYSTEM CABINET ARRANGEMENT (ELECTRONIC AUXILIARY ENCLOSURES)

15.1 General

The system cabinet typically consists of an enclosure containing:
- Circuitry, see 15.3.
- Internal wiring, see 15.5.
- Terminals and sockets for external wiring, see 15.6.
- Accessories, such as electrical supply units, see 15.8 and relays for operating blowers.

15.1.1 The total capacity of the cabinet shall include 10% for contingencies, i.e., to cover changes in the project scope which may occur.

15.1.2 The system cabinet typically consists of an enclosure containing:
- Circuitry, see 15.3.
- Internal wiring, see 15.5.
- Terminals and sockets for external wiring, see 15.6.
- Accessories, such as electrical supply units, see 15.8 and relays for operating blowers.

15.1.3 The system cabinet typically consists of an enclosure containing:
- Circuitry, see 15.3.
- Internal wiring, see 15.5.
- Terminals and sockets for external wiring, see 15.6.
- Accessories, such as electrical supply units, see 15.8 and relays for operating blowers.
during the engineering phase, plus 20% for future use.

15.1.3 Cabinets should be delivered with all slots wired to proper sockets/terminations/wrapping boards, to allow expansion of the system to maximum cabinet capacity, by card/module insertion only.

15.2 The Enclosure

15.2.1 System cabinets should be of the type and manufactured as specified by the Purchaser in the data sheets. Cabinets to manufacturer/supplier’s own standards require the approval of the Purchaser in writing.

Note:
The enclosure shall be constructed in sheet steel, be suitable for indoor use and meet the requirements of IP 41 of IEC 60529, unless otherwise specified.

15.2.2 The finish and color of the enclosure shall be as per Section10, unless otherwise specified in data sheet. A small quantity of touch-up paint say 0.25 Liter, shall be supplied with each cabinet.

15.2.3 The cabinet shall be fitted with removable eyebolts for lifting purposes.

15.2.4 The temperature inside the cabinet shall not exceed 10°C above the maximum control room temperature when all internal equipment and external loads are energized.

Note:
Cabinets will generally be installed in an environment with a temperature limit between 22 and 26°C (24±2) with humidity between 40 and 50%.

15.2.5 The limits shall be as stated in the data sheets, and it shall be ensured that the maximum allowable temperature inside the cabinet is not exceeded.

15.2.6 For temperature and humidity limits during storage and transportation, class C 1 of IEC 60654-1, and for mechanical vibration and shock, class VSI of IEC 60654-3, shall apply.

15.2.7 The allowance for air contaminants shall be as specified in the data sheets. ISA-S71-04, or
the final edition of IEC 60654-4, should be used as a guide for specifying environmental conditions.

15.2.8 Two options are available for cooling the cabinet internals depending on the amount of the heat generated inside:

a) Natural ventilation by means of screened and louvered openings in the doors and in the top of the cabinet.

b) Forced ventilation by means of openings in the doors fitted with dust filters and with extraction fans mounted in the top of the cabinet fitted with finger guards.

15.2.9 The manufacturer shall provide a calculation of heat generated under the worst possible conditions, i.e., with all loads energized, at the maximum ambient temperature.

15.2.10 The type of ventilation selected for the cabinet, based on the heat calculation provided by the manufacturer, shall be indicated in the data sheets. If the temperature under the conditions as specified, will remain within 10°C above the maximum ambient temperature, natural ventilation shall be applied. Otherwise forced ventilation will be required to limit the temperature rise inside the cabinet to within 10°C.

15.2.11 Side panels shall not be considered to give cooling effects.

Note:
When cabinets are bolted together with the side plates removed, it shall be ensured that the cooling airflow remains effective for all critical internal components.

15.2.12 A fan-failure alarm shall be provided for cabinets with forced ventilation. The alarm shall be available, either as potential free contacts on dedicated terminals in the cabinet, or as a dedicated socket, connected to the door of the cabinet and on the operating control desk.

15.2.13 Dust filters shall be of the replaceable or cleanable type, and this action shall be possible without disturbing the functioning of the cabinet.

15.2.14 Unless otherwise specified in the data sheets:
- Fans should be connected to an AC interruptible, maintained supply, (see 15.9).

- The cabinet shall be free standing with front and back doors, thus providing access to equipment, wiring and terminations.

15.2.15 If wall-mounted cabinets or back-to-back mounted cabinets are specified in the data sheets, all equipment, wiring and terminations shall be accessible from the front.

15.2.16 The side panels shall be removable so that it is possible to mount the cabinets side by side and properly connect them together. Therefore, the sidewalks shall not be used for cable entry or ventilation openings, etc.

15.2.17 The application of swing out frames requires the written approval of the Purchaser.

Note:
The application of swing out frames should be avoided wherever possible. They shall not be applied in cabinets for safeguarding equipment.

15.2.18 If swing-out frames are specified in the data sheets, special attention shall be given to the maximum weight of equipment allowed on the frame in the swung out position. The connecting wire "bundle" to the equipment on the swing out frame shall be adequately protected. Doorstops and swing-frame stops shall be provided.

15.2.19 The size of the cabinet shall be stated in the data sheets and should be selected from the following sizes:

<table>
<thead>
<tr>
<th>Height mm</th>
<th>Depth mm</th>
<th>Width mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/2100</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>2000/2100</td>
<td>600/800</td>
<td>800</td>
</tr>
<tr>
<td>2000/2100</td>
<td>600/800</td>
<td>1200</td>
</tr>
</tbody>
</table>

15.2.20 The height indicated above may include a plinth for door clearance, etc. All dimensions given are in millimeters.

15.2.21 The size of cabinets, i.e., height and depth, should be consistent within the same control or auxiliary room.

15.2.19 The height indicated above may include a plinth for door clearance, etc. All dimensions given are in millimeters.

15.2.21 The size of cabinets, i.e., height and depth, should be consistent within the same control or auxiliary room.
15.2.22 For enclosures having a width of 600 mm maximum, one door is acceptable, for wider enclosures two doors should be provided. Doors and side panels shall be easily removable.

Note:
Single doors of 800 mm may be applied provided escape routes allow for such doors. Regulations for escape routes shall be adhered to.

15.2.23 For those systems where observation of the equipment by operating or electrical maintenance personnel is required without opening the doors, clear acrylic windows or laminated glass windows shall be specified in the data sheets.

15.2.24 Each cabinet should be provided with either a separate handle and lock or with a lock inserted in the handle. Unless otherwise specified in the data sheets, the locking arrangement shall be to manufacturer’s standards. Each lock shall be identical for all cabinets provided by the same supplier and these cabinets shall have 2 keys.

15.2.25 For extensions to existing plants, the locks and handles should preferably match those of the existing cabinets.

15.2.26 Cable entry shall be in the bottom of the cabinet unless otherwise specified by the Purchaser. Sufficient freely accessible space shall be available for accommodating and terminating all cables. The cabinet shall be provided with properly designed cable clamps and cable support rails in order not to exert any undue force on terminations.

15.2.27 Unless ventilation is required through the bottom of the cabinet, all holes remaining after entry of the cables shall be properly sealed against the entry of dust. The dust seal shall be such that it is easily removable for the entry of other cables.

15.3 The Circuitry
The power and output circuits shall be rated for simultaneously energizing the complete system. All output circuits shall be short-circuit proof, and the shorting of one output circuit shall not affect other circuits.
15.3.1 Initiating circuits (field instruments)

15.3.1.1 General

Initiating circuits do not form part of this Standard; however it shall be ensured that the specifications of the initiating circuits are compatible with those of the system cabinet circuitry as appropriate.

15.3.1.2 Contacts

The system circuitry shall be capable of operating with initiating devices which are free from earth, potential-free, and of the snap-acting type, with the contacts closed in the normal condition and open in abnormal conditions. Typical electrical characteristics for initiating contacts are given in Appendix B. For initiating devices other than contacts, the electrical characteristics shall be as specified in the appropriate data sheet.

Notes:

1) The current passing through the initiating contacts shall be at least 1 mA DC and energy needed for initiating a change in system status shall be at least 10 mW.

2) The initiating devices may be located in a hazardous area, in which case the type of protection shall be suitable for those areas.

15.4 Electronic Card Frames

a) The circuit cards shall be mounted vertically in card frames which are securely fixed to standard 480 mm (19 inch) racks in the enclosure. The height of the racks shall be subject to the approval of manufacturer’s standard.

b) The card frames shall be provided with connectors and card guides enabling the correct insertion of the circuit cards, and providing adequate separation, both electrically and mechanically, between them.

c) Each card frame and the card which will be inserted, shall be marked for identification, either by consecutive numbering and type, or if agreed by the user, by the manufacturer’s standard code.
d) Spare positions shall be fitted with edge connectors and blanking plates.

15.4.1 Mounting plates

When a cabinet is used for housing a variety of discrete components, either rack-mounted or individually on a mounting plate, the following constructional details shall be taken into account:

a) Earthing of the mounting plate;

b) Provision of sufficient space for the removal of covers and for testing;

c) Building of a dedicated tester/adjuster as appropriate if the cabinet contains many similar items;

d) Equipment removal from the front without disturbing other equipment;

e) Accessibility of all wiring and terminations from the front;

f) Cable entry, which shall be in accordance with clause 15.2.

15.5 Internal Wiring

15.5.1 The internal wiring shall be adequately sized for the required voltages and currents. The conductor cross-section shall be such that the voltage drop is less than 2%.

15.5.2 When a large number of wires are laid together in ducting or in a bundle, a current derating of 50% of the nominal rating should be applied.

15.5.3 All wires in screw type terminals shall be provided with wire markers.

15.5.4 Unless otherwise specified in the requisition, or agreed by the user, the color coding of wires shall be as table 1:
### TABLE 1- CODING AND COLOR OF WIRES

<table>
<thead>
<tr>
<th>Coding of Wires</th>
<th>Color of Wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Power 24 V DC positive</td>
<td>- Red</td>
</tr>
<tr>
<td>2. Negative</td>
<td>- Black</td>
</tr>
<tr>
<td>3. Voltage, Phase</td>
<td>- Green/Yellow</td>
</tr>
<tr>
<td>4. Neutral</td>
<td>- Green</td>
</tr>
<tr>
<td>5. Input and output signals</td>
<td>- Light Blue</td>
</tr>
<tr>
<td>6. Safety earth</td>
<td>- White (or blue , for intrinsically safe signals)</td>
</tr>
<tr>
<td>7. Signal earth</td>
<td>- White</td>
</tr>
<tr>
<td></td>
<td>- Green/Yellow</td>
</tr>
<tr>
<td>8. Thermocouple extension wires</td>
<td>- Green/Yellow</td>
</tr>
</tbody>
</table>

**Notes:**

1) Signal wiring from internal supply with a voltage higher than 50 V and signal wiring from external supply sources with a voltage higher than 50 V may be suitably colored to provide an additional warning. The colors Orange and Orange/White should be used respectively, if not otherwise specified in the requisition.

2) Care shall be taken that interference susceptible signal lines are not affected by high current carrying lines. Refer to IPS-E-IN-190 transmission systems.

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15.5.5 All wiring should be laid in PVC ducting with a removable cover. Intrinsically safe wiring shall be contained in separate ducting. The cover of this ducting should be colored blue.

15.5.6 For new projects, at least 30% spare capacity shall be available in the ducting when all wiring is complete.

15.5.7 Spare wires shall not be left loose in the ducting, they shall be properly terminated.

15.5.8 Connections shall not be made in the ducting.

15.5.9 Wires and cables in the ducting shall not have excessive spare length.

Yada Aravi:

1) سیم کشی سیگنال از نگهداری داخل با ولتاژ بیشتر از 50 ولت و سیم کشی سیگنال از نگهداری خارجی با ولتاژ بیشتر از 50 ولت ممکن است بطور مناسب در جهت اختصار اضافی رنگ شده باشد.

2) باید مطمئن بود که تداخل خطوط سیگنال مستعد پدید نشود با حداکثر حداکثر پدید آورنده اثر گذار نباشد. جهت اطلاع بیشتر به استاندارد 190 سیستم انتقال مرجع شود.

لیبل سیم کشی‌ها باید در دکت پربوی از دو کانال ظهور کند. سیم کشی دارای ایمن در دکت چندکانال باید باشد. درآورنده دکت کشی باید رنگ آبی باشد.

برای پروژه‌های جدید، حداقل 30 درصد نظری یکی در دکت کشی وقتی که سیم کشی کامل شده باشد در نظر گرفته شود.

سیم‌های بادکنک در دکت آزاد گذاشته شده در انتقال انجام شده باشد.

در داخل دکت نیازی به دکت کشی بادکنک در دکت تکه‌ای اضافی داشته باشد.
15.5.10 Wiring shall lie neatly in the ducting even when the covers are removed.

a) Socket and prefabricated cable connected to plug shall be used for cabinet interconnection.

b) The loops shall be arranged such that force is not exerted on the plug/socket assembly.

c) The socket-board can be reached for fault finding or adding wiring for new circuits, with the wiring technique as selected from 15.6.1.

d) Sufficient access and space should therefore be available.

15.5.11 The socket-boards shall be mounted in the cabinet such that:

a) The plugs can be easily inserted or withdrawn, sufficient space shall be available for the plugs and the cable loops.

b) The loops shall be arranged such that interchanging between different types of voltages are not possible. Signal segregation for such interconnection.

c) The socket-board can be reached for cabinet interconnection.

15.5.12 Plugs and sockets shall have a polarity code such that interchanging between different types of voltages are not possible. Signal segregation for Intrinsically Safe signals shall be in accordance with the requirements of IEC 60079-11.

15.5.13 All terminations using screw type terminals shall be straight through, non-pinching and spring backed to hold the wire, with only one wire in each terminal. The type and manufacturer of the terminals shall be specified in the data sheets.

15.6 Wiring Techniques

15.6.1 The following techniques should be applied for the termination of internal wiring:

a) Crimped-on contacts and pins:

1) Shall be used for stranded flexible wires of minimum size 1.5 mm², voltage rating 250 V and with insulation suitable for temperatures up to 80°C.

2) The manufacturer's recommendations shall be followed for the size of the crimp pins and contacts and for the type and correct application of crimping tools to produce high quality connections consistently.
15.7 Earthing

15.7.1 A safety-earth connection shall be provided for every cabinet. Conducting parts such as doors and frames, etc., which are not permanently connected to safety-earth, shall be connected to the cabinet frame with flexible braided earthing strips of 6 mm² minimum size.

15.7.2 Safety earthing shall be connected to a dedicated earth-bolt of M8 minimum size, provided with an earth symbol marker.

15.7.3 Where local regulations are more stringent

Notes:

1) The crimping tools shall be checked for wear at regular intervals and be replaced when manufacturer’s tolerances have been exceeded.

2) The tools shall have a single torque value and be of the non-return type until the crimp has been made.

3) Crimp connections shall not be made on solid wires (solid wires shall be used only for thermocouple extension wires).

b) Wire wraps connections:

This technique is used with small wire sizes, not less than 0.2mm². The application of this method shall be approved by the Purchaser.

15.6.2 The wiring for power supply units shall have terminal connections with the rating adequate for the load.

15.6.3 The selected wiring technique shall be as stated in the requisition. The terminations and wire sizes may be to manufacturer’s standards, but only with the approval of the Purchaser.

Note:

Soldered connections shall not be used for internal wiring.

15.6.4 Quality control procedures for the proposed wiring technique shall be submitted to the Purchaser for approval.

15.6.5 A set of crimping/wrapping tools together with a quantity of the required wire and crimp pins etc. shall be supplied with the cabinet(s), to facilitate any modifications that may be necessary during commissioning.

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than the above requirements, this shall be indicated in the requisition and they shall be complied with.

15.7.4 Each cabinet shall have a tinned copper earth-bar for signal earth connections and sufficient screws shall be available for making the connections. The signal earth-bar shall be insulated from the cabinet frame. Earth connections shall be as short as possible and of adequate cross sectional area.

15.7.5 To avoid flash-over between signal earth and safety earth, over-voltage protection devices should be applied, limiting the voltage difference to 65 volts approximately.

15.7.6 For additional lightning protection requirements, see the standard of "Transmission Systems", IPS-E-IN-190.

Note:
If the equipment installed in the cabinet requires the connection of signal-earth to the cabinet frame because it is the manufacturer’s standard, then the cabinet shall be mounted such that it is insulated from safety earth and the building structure.

15.7.7 Earthing details of cabinets shall be shown on separate drawings as part of the complete set of drawings for earthing details.

System manufacturer requirement shall be adhered to.

15.8 Instrument Electrical Supply

15.8.1 General requirements

15.8.1.1 The system shall be suitable for operating from a supply as defined in Appendix A. The selection shall be indicated in the requisition. Without considering redundancy, a spare capacity of 25% of the maximum allowable load shall be available.

15.8.1.2 The power sources shall be of a design to suit the requirements of the system. The manufacturer shall ensure that the power sources do not introduce interference into the system.

Notes:
1) Power supply units shall be of the simplest design to fulfil the requirements of the system.
2) Inrush currents and short circuit currents shall be limited, to avoid damage to the power supply units.

15.8.1.3 A fuse/circuit breaker schematic diagram shall be prepared for each system cabinet, together with calculations indicating power distribution, fuse ratings, fuse types (size and current-time characteristics), terminations and total worst-case power consumption.

Note:
The information shall be available at an early stage of the project and be updated regularly, to enable electrical engineering department to selectively size the fuses in their supplies.

15.8.1.4 The data sheet shall indicate if the supply for the circuitry in the cabinet will be floating or earthed on one side.

Notes:
1) The earth systems, have common zero and earthing on one side. The written approval of the user shall be obtained in these cases.

2) Floating supplies are applied in order to obtain a high integrity of the system and to enable an early detection of a fault or start of a fault by means of earth leakage detection.

3) Special attention shall be paid to all inputs and outputs to and from cabinets with a floating supply, and to interconnections with other systems in order to ensure that the earth-fault detection can function properly, i.e., circuits fed from supply with earth-leakage detection shall be completely separated from those fed by some other supply by means of potential-free contacts or by galvanic isolation circuits.

15.8.1.5 Earth leakage monitoring shall be provided in the electrical distribution board, i.e., for the floating DC supply system, and should form part of the system cabinet power supply arrangement.

15.8.1.6 Potential free contacts shall be available for alarm on the operator’s panel / work station, for earth leakage detection system.

15.8.1.7 If the intention is to provide an uninterruptible power supply, maintenance of the supply or supply units in the system cabinets, shall be limited, to avoid damage to the power supply or supply units.

15.8.1.8-1-1

Notes:
1) Earth leakage monitoring shall be completely performed by a fuse/earth leakage detection system.

2) The earth systems have common zero and earthing on one side.

3) The written approval of the user shall be obtained in these cases.

4) The earth systems have common zero and earthing on one side.

5) The earth systems have common zero and earthing on one side.

6) The earth systems have common zero and earthing on one side.

7) The earth systems have common zero and earthing on one side.

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9) The earth systems have common zero and earthing on one side.

10) The earth systems have common zero and earthing on one side.

11) The earth systems have common zero and earthing on one side.

12) The earth systems have common zero and earthing on one side.

13) The earth systems have common zero and earthing on one side.

14) The earth systems have common zero and earthing on one side.

15) The earth systems have common zero and earthing on one side.
be possible without disturbing the supply.

Notes:

1) Details of the required power supply arrangement given in the requisition, shall also indicate the amount of redundancy and the maintenance facilities required, such as indications for overvoltage, under voltage, overload and isolation of incoming power.

2) With built-in power supply units, due attention shall be given to the wiring and terminations, with respect to on-line servicing possibilities.

3) Power supply units should be located in the top of the cabinet to avoid unnecessary heating of the cabinet internals.

4) The supply arrangement inside the cabinet shall include protection against polarity reversal.

15.8.1.8 Power supply terminations shall be clearly identified and numbered and wiring shall be kept separate from interference susceptible wiring.

15.8.1.9 Power supply group numbers and distribution board numbers shall be clearly identified inside the system cabinets.

15.8.2 Batteries inside cabinets

The application of batteries inside cabinets requires the written approval of the user. All such batteries shall be clearly identified and the following minimum requirements shall be adhered to:

- Sealed batteries shall be applied, otherwise agreed in writing by the user.

- The temperature shall be kept below 30°C for efficient use of the battery.

- Facilities for on-line replacement and checking shall be provided.

- Full documentation, such as maintenance instructions, area classification and expected lifetime shall be supplied.

- The batteries shall be tested for capacity during commissioning on site according to the battery manufacturers instructions. If the capacity is less than 80% of the rating they shall be replaced.

- Small, low cost batteries for memory protection etc. shall be renewed without testing.

- All batteries in the cabinet shall be clearly identified, e.g. on the inside of the door stating:

  باید بدون قطع تغذیه سیستم امکان پذیر باشد.

  نکات:

1) جزئیات چیدمان منبع تغذیه لازم در برگ درخواست خرید داده شده، باید نشانگر مقدار انرژی و تجهیزات تعمیراتی لازم باشد، مثل نشان دهنده اضافه و لنجان، اضافه بار و جدا سازی قدرت و رودی.

2) در باتری های تغذیه همراه با سیستم، باید به سیم کشی و سربندی با توجه به امکانات خدمات روز خط توجه کافی می‌باشد.

3) دستگاه‌های منبع تغذیه در جهت حل‌گیری از گرم شدن غیر ضروری داخلی کابینت باید در بالای کابینت نصب گردد.

4) چیدمان تغذیه در داخل کابینت باید شامل حفاظت در مقابل مخوس شدن قطب ها باشد.

15.8.1.8- 15.8.1.9 شماره‌های گره منبع تغذیه و شماره‌های کابینت و توزیع باید در داخل سیستم کابینت ها مشخص شود.

15.8.1.8- 15.8.1.9 باتری‌های داخل کابینت‌ها

استفاده از باتری‌های داخل کابینت‌ها، اجازه کننده کاربر را لازم دارد، این باتری‌ها باید بطور واضح مشخص شده و الزامات حداکثر زیر را داشته باشند:

- باتری‌های آب بندی شده باید تهیه شود، مگر با توافق کننده کاربر.

- در جهت استفاده بهبود از باتری، دما باید زیر ۳۰ درجه سیلسیوس نگه داشته شود.

- تجهیزاتی برای یاگزینی و آزمایش ریوی خط باید تهیه گردد.

- کلیه اسناد، مانند دستورالعمل‌های تعمیراتی، طبقه بندی محوطه و عمر منفی مرد نظر باید داده شود.

- جهت تعیین ظرفیت در مدت راوان‌دازی در محوطه طبق دستورالعمل‌های سازنده باتری، باید آزمایش شوند. در صورتی که ظرفیت باتری‌ها کمتر از ۸۰ درصد اندانه تعیین شده باید کابینت جاگزینی گردد.

- جهت حفاظت حافل‌های و غیره، باتری‌های کوچک و ارزان قیمت باید بدون آزمایش تعویض گردد.

- کلیه باتری‌‌ها در کابینت‌های باید به طور واضح مشخص شوند.
type, function, date fitted, date checked, date of renewal, etc.

15.9 Identification

15.9.1 Each cabinet shall have a nameplate of corrosion resistant material fixed on to the front of the cabinet, with screws, and giving the following information:

- Name of purchaser,
- Serial number of the unit,
- Rating in watt,
- Voltage and frequency,
- Purchase order number,
- Year of manufacture.

15.9.2 Live parts of equipment and terminations carrying voltages above 50 volt shall be covered with a transparent insulation plate, bearing the warning text: DANGER.

15.9.3 All equipment, relays, sockets, wiring, terminals, etc. shall be clearly identified by nameplate in accordance with the relevant drawings included in the data sheet.

15.9.4 These nameplates shall be properly fixed using a 2 component epoxy resin cement near to the equipment on non-removable parts of the cabinet.

15.9.5 Nameplates shall be prepared in accordance with the requirements of nameplates standard.

16. ERGONOMIC DESIGN CONSIDERATION

16.1 Shared Visual Displays, Off-Work Station

The requirements presented in this clause concern the location of shared visual displays within the control room. Many differing technologies can be used for overview visual displays, including banks of closed circuit television (CCTV) monitors, hard-wired mimics and static maps/diagrams.

When designing control room layouts for these differing solutions, the constraints imposed by the various solutions will need to be considered. Such constraints include limitations on viewing angle, contrast ratios and image construction. As an alternative to large shared displays, the option of presenting this information on the control
workstation, with smaller schematics, should be considered.

16.2 Horizontal and Vertical Viewing Distances
In particular, the following has to be taken into account.

16.2.1 Where off-workstation visual displays need to be used on a regular or continuous basis, the preferred position is directly in front of the control room operator such that they can easily be seen when looking over the control workstation or can be scanned by eye-movement alone (see Figure 1).

![Diagram of viewing distances]

1. Operator
2. Horizontal visual field
3. Off-workstation visual display

Note: This plan view is intended to show general principles.

Fig. 1- PREFERRED LOCATION OF OFF-WORKSTATION VISUAL DISPLAYS

Note: For more information on Ergonomic Consideration, see IPS-G-IN-220.

17. SYSTEM PERFORMANCE
17.1 Burn-in Period
17.1.1 When specified in the data sheet each system cabinet containing active elements, shall be completely assembled and subjected to a 100 hours burn-in period at elevated temperature and with all loads energized.
17.1.2 After the burn-in period the system shall comply with the performance requirements and successfully pass the other tests indicated in this section.

17.1.3 Detailed procedures for the burn-in period and the other tests indicated in this section, shall be submitted to the user together with the proposed dates for the tests, in order that they may be witnessed by the Purchaser.

17.1.4 A record shall be prepared during burn-in and testing, indicating failures and replacements or repairs of any components, the record shall include data such as temperature and humidity etc., with reference to the applicable environmental specification. This record shall be regularly updated and be available for review by the purchaser or his representative, at any time during the tests.

17.2 Reliability

17.2.1 When specified in the requisition, the reliability shall be stated by the manufacturer/supplier for the system cabinet which he will supply. The figures to be provided should be; mean time between failure (MTBF) for both nuisance and serious failure with an assumed mean time to repair (MTTR) of 8 hours.

17.2.2 To determine the definition of failure for the system to be supplied, advice shall be obtained from the purchaser’s specialist.

17.2.3 Data and calculations shall be provided to substantiate the figures quoted for the system cabinet.

Note:
Typically, the reliability should be determined in accordance with the requirements of IEC 60605, and a detailed test specification should be prepared by the manufacturer or an independent third party.

17.2.4 The test specification and the independent third party to be involved in the testing shall be subject to the approval of the Purchaser.

17.2.5 Unless otherwise specified by the Purchaser, the failure reporting shall be in accordance with the IEC publications referred to above.

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17.3 Type Test

17.3.1 General

To ensure that the design of the system cabinet complies with the requirements intended by the Purchaser, at least one system cabinet of each design should be subjected to, and successfully pass the type tests defined below. However, some of the tests indicated in this section may be waived with the written agreement of the Purchaser.

17.3.2 Bench tests

The supplier shall indicate in the quotation, to which severity the equipment and the circuitry may be tested.

17.3.2.1 Interference rejection

The system shall respond within the specified tolerances, when using the initiating devices as specified to carry out the following tests:

- **Series Mode**
  
  Using the circuit of Fig. 2 of Appendix B, an interfering signal of 1 Volt AC (rms) at mains frequency, shall be applied from a source with an output resistance of 30 ohms.

- **Common Mode**
  
  With reference to Fig. 3 of Appendix B, a signal of 100 Volt AC (rms), shall be applied to the initiating circuit with respect to the earth.

**Note:**

Where applicable, other voltage values may be proposed by the supplier.

17.3.2.2 Electrical supply tolerances

The system shall function, within the specified tolerances, when the electrical supply is varied within the allowed tolerances for the selected type of supply, see Appendix A.

17.3.2.3 Electrical supply transients

The system shall function, within the specified tolerances, when the following pulses are superimposed on the supply voltage for the durations indicated:

- **17-3-2-3 3-2مومعی**
  
  در جهت اطمینان از اندازه طراحی سیستم کابینت طبق خواسته خریدار باشد، حداقل یک سیستم کابینت از هر طراحی باید 3-2مومعی تعیین شده در زیر را با موقفی گذاری می‌باشد. به‌طور عادی از آموزش‌های اشاره شده در این قسمت ممکن است با نظر و توافق کننده طراحی اعماد گردد.

- **17-3-2-2-2 3-2مومعی**
  
  تأمین 3-2مومعی در میز کار باید در پیشنهاد خرید، طول عمر تجهیزات و مداربندی که ممکن است آزمایش شوند را ارائه نماید.

- **17-3-2-1 3-2مومعی**
  
  وقتی که پیشنهاد راه‌نامه متناسب نماید که آموزش‌های زیر باید انجام شود، سیستم باید به رواداری‌های (تلرانس‌های) تعیین شده عکس عمل نشان دهد:

  - **حالت سری**
    
    با استفاده از مدار شکل 2 پیوست (ب)، سیگنال تداخل یک ولت جریان متناوب موتر (rms) در فرکانس منبع، باید از منبع با مقاومت خروجی 30 اهم، تزریق شود.

  - **حالت مشترک**
    
    با استفاده از شکل 3 پیوست (ب)، سیگنال هر جریان متناوب موتر (rms) باید به مدار راه انداز با توجه به اتصال زمین تزریق شود.

**یادآوری:**

جاییکه لازم نباشد، ولاترنس‌های دیگر ممکن است توسعه تأمین کند که پیشنهاد گردد.

- **17-3-2-3 3-2مومعی**
  
  وقتی که منبع تعیین برخورد را محدوده رواداری‌های (تلرانس‌های) مجزا و منبع تعیین انتخابی تغییر یابد کند، سیستم باید به رواداری‌های (تلرانس‌های) تعیین شده عمل کند، به پیوست (الف) مراجعه شود.

- **17-3-2 3-2مومعی**
  
  وقتی که بالس‌های زیرین روی ولتاژ منبع تعیین در مدت زمان اشاره شده سوار نشده باشد، سیستم باید به رواداری‌های (تلرانس‌های) تعیین شده عمل کند.
17.3.2.4 Radio-frequency interference (Refer to IEC 61000-3)

The system shall be subjected to an interference test at radio frequencies, by operating a portable transmitter/receiver at a distance of one meter from the cabinet, with the doors open and the maintenance extender circuit card(s) installed. The electric field strength measured at the cabinet shall not exceed 5 V/m.

Notes:

1) As an alternative to measuring, the electric field strength may be calculated using the following formula:

\[ E = \frac{(1.6 \sqrt{P})}{d} \]

Where:

- \( E \) is the electric field strength in v/m;
- \( P \) is the rated power of the portable transmitter/receiver in watts, and
- \( d \) is the distance between the transmitter/receiver and the cabinet in metres.

The portable transmitter/receiver shall be fully charged and the condition shall be in accordance with the manufacturer’s specification.

2) The distance shall never be less than that indicated in Fig. A-4 of IEC 60801-3 for far fields.

The test shall be carried out at frequencies of 70-170 MHz, 460 MHz. During the test, digital signals shall not change status, and analogue signals shall not change by more than 0.5% of the span.

The requisition shall indicate the frequency of any portable transmitters used at the destination site. This frequency shall be specifically checked during the test. Any deviation from the above procedure shall be approved by the Purchaser in writing.

17.3.2.5 Short-circuiting of output terminals.

17.3.2.6 Earthing of input terminals.
The supplier shall indicate, in his quotation, if these tests are possible with the equipment to be supplied.

17.3.3 Climatic and environmental tests

17.3.3.1 General

When carrying out any of the following tests, the cabinet shall be completely assembled, mounted and enclosed as for the actual installation. Functional checks shall be made before, during and after each test.

As agreed with the Purchaser, a number of tests shall be selected from table 2 with severities as specified and related to the environment in which the cabinet will operate.

<table>
<thead>
<tr>
<th>TESTS</th>
<th>REFERENCE TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry heat</td>
<td>IEC 60068-2-2</td>
</tr>
<tr>
<td>Cold</td>
<td>IEC 60068-2-1</td>
</tr>
<tr>
<td>Damp heat</td>
<td>IEC 60068-2-3 Part 2 Test Ca</td>
</tr>
<tr>
<td>Vibration</td>
<td>IEC 60068-2-3 Part 2 Test Fc</td>
</tr>
<tr>
<td>Impact</td>
<td>As specified</td>
</tr>
<tr>
<td>Corrosion SO2</td>
<td>IEC 60068-2-42 Part 2 Test Kc</td>
</tr>
<tr>
<td>Corrosion H2O</td>
<td>IEC 60068-2-43 Part 2 Test Kd</td>
</tr>
</tbody>
</table>

18. FACTORY INSPECTION AND TESTING

18.1 Unless otherwise specified in the requisition, all system cabinets and panels shall be inspected by the user’s nominated inspector before leaving the factory. The inspection shall be carried out in accordance with the requirements of factory inspection and testing of instruments and instrument system standard, IPS-I-IN-100.

18.2 Inspection shall take place after all works has been completed, including the factory burn-in (see 17.1) and testing by the manufacturer as appropriate. The user shall be informed at least ten working days in advance of when the inspection can be made.

Note:

If for any reason the user waives inspection, this shall not relieve the manufacturer/supplier of the responsibility to repair, at his cost, any defects found later.
18.3 The manufacturer shall provide free of charge simulation and test apparatus, together with personnel for carrying out the tests indicated in this specification, the data sheets and the inspection plan.

18.4 If simulation and test equipment is part of the order, this equipment shall be used during the inspection and testing.

18.5 Any defect found by the purchaser’s inspector shall be rectified in his presence. Where this is not possible, check lists shall be prepared stating all pending items for signature by the purchaser’s inspector. Copies of these lists shall be sent to the equipment’s destination for their subsequent checking.

18.6 The equipment shall not be shipped before all discovered defects have been corrected and satisfactorily retested.

18.7 Re-testing of the related systems after correction of the defects, shall be carried out as indicated by the purchaser’s inspector.

18.8 The inspection outlined above is considered only as an agreement for shipping the equipment, it shall not be considered as a formal acceptance of the equipment by the Purchaser.

19. PACKAGING AND TRANSPORTATION

19.1 The manufacturer/supplier shall remove all side mounted instruments and ship them separately from the cabinet(s) and panel.

19.2 Prior to packing, all open ended pipes shall be adequately sealed to prevent ingress of dust and moisture. All loose pipes, cable loom, etc., which are disconnected for ease of shipment, shall be secured and identified.

19.3 The manufacturer/supplier shall inspect and approve the loading and bracing to ensure that damage will not occur during transit.

19.4 All sensitive meters such as millivolt and milli amp meters shall be "jumpered" on the input to give damping against mechanical shock.

19.5 Prior to packing, all cabinets should be mounted on a suitable skid and coated with a strip-off lacquer.

20-18  3-2  سازندگان دستگاه‌های آزمون و شیمی‌سازی، هر چه گران کارکنان جهت انجام آزمون‌ها که در آن استفاده، در داده برگ‌ها و برنامه بازرگان ارائه شده است، بايد فراهم نماید.  

20-18  3-4 اگر تجهیزات آزمون و شیمی‌سازی جز قسمتی از سفارش می‌باشد، این تجهیزات باید در مدت زمان آزمایش و بازرگان استفاده قرار گیرد.

5-20 هرگونه خرابی توسط بازرگان مشاهده شود، باید در حضور ایشان رفع گردند. در صورت عدم امکان رفع عیب، فهرستی از اقلام باقی مانده به امضای بازرگان باید به‌هم گردد. کی باید فهرست باید به مقصد ارسال تجربات جهت آزمایش‌های بعدی ارسال گردد.

4-20 قبل از تعمیر و آزمایش‌های رضایت بخش خرابی‌های کشف شده، تجهیزات نیابید حمل گردد.

2-18 آزمون دوباره سپس‌های مرتب بس از تصحیح خرابی‌ها که توسط بازرگان خریدار عنوان شده باید انجام گیرد.

8-20 بازرگان عنوان شده در بالا فقط با تواقه جهت حمل تجهیزات در نظر گرفته می‌شود. این بازرگان نیاید به عنوان پذیرش رسما تجهیزات توسط خریدار تلقی گردد.

19-19 بازنده و حمل و نقل

19-19  3-1 سازندگان با تأمین کننده باید کلیه تجهیزات ابزار دقیق نصب در کنار کابینت را جدا نموده و آنها را جداگانه از کابینت‌ها و نباید حمل نماید.

19-19  3-1 قبل از بازنده، کلیه اشیایی باز لوله‌ها باید به طور مناسب در جهت ورود گرد و خاک و رطوبت ایبی‌سیدی شوند. کلیه لوله‌های آزاد، دست‌سازه کابل و غیره که جهت سهولت حمل و نقل باشند، باید علامت‌گذاری و محکم بسته شوند.

19-19  3-1 سازندگان با تأمین کننده باید بازگذاری و استعداد داره آرایش و نمایند تنها که در موقع حمل و نقل خارج وارد نخواهد شد.

19-19 دستگاه‌های اندازه‌گیری حساس مثل اندازه‌گیری‌های میلی ولت و میلی آمپر باید در ورودی آنها "جایگیر" نمود تا در مقابل شوک‌های مکانیکی حفاظت شوند.

19-19 قبل از بازنده، کلیه کابینت‌های باید روی تیر بالین مناسب با چسب قابل کنند روکش شده باشد.
19.6 If cabinets and panels are subjected to overseas transit and exposed to storage under adverse conditions, the following minimum specification is given as a guide to the degree of protection required:

- The units shall be sealed in suitable plastic envelopes, humidity indicators fitted and sufficient desiccant for 12 months storage enclosed.

- Cabinets and panels shall be bolted to the base of the packing case with interposed shock proof mountings, and cushioned with an adequate thickness of packing material on sides, ends and the lid.

- The framed base, sides and ends of the packing case shall be constructed of 22 mm thick tongued and grooved close boarding and lined with reinforced waterproof paper.

- The lid shall be lined with roofing felt backed by 3 mm plywood.

19.7 The manufacturers/suppliers final packaging specification is subject to the purchaser’s approval.

19.8 The shipping mark, Purchase Order Number and any other particulars as requested in the requisition, shall be stenciled on each separate package and/or on the outside of each wooden case or crate.

19.9 The cabinet and panel manufacturer/supplier shall inform the Purchaser of the estimated total weight and dimensions of each shipping section of the cabinet and its termination rack, within four weeks of the acknowledgment of the Purchase Order.

20. GUARANTEE

20.1 The manufacturer/supplier shall guarantee all works and materials in his supply against defect, poor workmanship, improper design, improper packaging and/or failure in normal use for 12 months after the system has been placed in service but not exceeding 18 months after date of delivery.

20.2 The manufacturer/supplier shall repair or replace within one week, without any charge to the Purchaser, the parts found defective within the time specified above. In no event will this guarantee cover defects due to normal wear and tear or due to disregard of manufacturer/supplier’s operating instructions.
20.3 The guarantee period shall be extended by any period(s) equal to the period(s) during which the system has been out of operation as a result of a defect covered by this guarantee.

20.4 Fresh guarantee periods equal to those specified above shall apply to replacement parts or repaired parts.

20.5 The manufacturer/supplier shall guarantee at least (15) years spare parts supply.

21. PURCHASING PROCEDURES

In addition to the general purchasing conditions, the following requirements shall also apply when supplying system cabinets and control panels.

21.1 Extent of Supply

21.1.1 Each system cabinet and control panel shall be as specified in this standard, the data sheets and the documents listed therein. In case of a conflict between these documents, the order of priority shall be as follows:

- The Purchase Order.
- The data sheets.
- The documents listed in the data sheets.
- This standard.

21.1.2 Each system shall be supplied with an adequate number of special tools if applicable, (e.g., for the mounting and/or removal of lamps or switches).

21.1.3 The cabinet or/and control panel shall be delivered completely assembled for erection at site, except for those parts removed for packing, without further preparation.

21.2 Quotation

21.2.1 Quotation shall be submitted in three forms, one with prices (commercial quotation), the second without price (unpriced commercial quotation) and the third (technical quotation).

21.2.2 The following information shall be included in the quotation:

a) The price for the complete system cabinet or/and control panel as specified by the purchaser, together with the price for:

- Witnessed testing of the system;
- Furnishing of drawings;
- Compilation of spare parts data (if any);
- Furnishing of installation and maintenance data;
- Provisions for transport, including packaging;
- Transport charges to the delivery point mentioned in the enquiry;
- Turnover tax, if any.

b) A copy of the certificate of intrinsic safety (if applicable).

c) Current rating of contacts used to energize external devices.

d) Dimensional outline drawing showing the position of the equipment in the cabinet or/and control panel.

e) Typical internal arrangements drawing showing the position of the equipment in each cabinet control or/and panel.

f) Other details as requested in this standard and the data sheets.

g) Items on which the equipment offered deviates from the purchaser’s specifications.

h) A statement that the equipment offered satisfies the type tests specified in (clause 18.4) and/or detailed listings of items which do not comply with the specified performance criteria.

i) A proposal for erection/commissioning assistance (hourly rate plus expenses).

j) Proposal for site modifications (hourly rate plus expenses).

k) A provisional time schedule for meeting the delivery date indicated in the data sheets detailing activities such as preparation of drawings, requisitioning of material, start of fabrication, ready for inspection and ready for shipping.

Note:
Items a, i, and k are applicable for commercial quotation only.
21.3 Documentation

21.3.1 In the event of an order being placed, the number of copies and electronic files of the preliminary documents and drawings to be sent for approval and the final as built document and drawings to be supplied, will be specified in the purchase order.

21.3.2 At least 1 set of electronic files of drawings shall be available at the site when the cabinet or/and control panel arrives.

21.3.3 The documents and drawings which shall be prepared includes but is not restricted to the following:

- Outline drawing showing dimensions in (mm) and mass of cabinets, or/and control panels.
- Installation and maintenance instructions.
- Description of operation.
- Electricity consumption with all loads energized.
- Schematic wiring and cable connection diagrams of the complete system.
- Terminal arrangements.
- Description of test procedures.
- Earthing arrangement.
- Power distribution with fuse ratings/types.
- Internal wiring diagrams or lists.

Note:
In order to be able to prepare and execute future modifications efficiently, internal wiring shall be clearly identified on drawings or schedules such that the routing of every wire can be derived from it.

- Detailed information on all items bought out by the Manufacturer.

Note:
The System Cabinet and control panel supplier is responsible for the supply of drawings and documents of free issue equipment fitted by him in the cabinet or/and control panel in the quantities stated in the Purchase Order.

21.3.4 Format, layout and contents of all documents and drawings shall be approved by the
Purchaser at an early stage in the project. Standard forms and examples of typical forms will be supplied to the manufacturer with the requisition as appropriate.

21.3.5 SPIR (Spare Parts Interchangeability Record) shall be completed for the precommissioning/commissioning and normal operation of the cabinet, for all cabinet, and panel mounted components including bought-out items, within six weeks after receipt of the Purchase Order. This should ensure the timely purchase and shipment of spare parts.

21.3.6 The Manufacturer/Supplier shall clearly mark the spare parts interchangeability lists with the Purchaser Order reference and item number, unit type indication and serial number.

21.3.7 Spare parts list shall show for each part:

- Description;
- Drawing/part number;
- Identification number;
- Interchangeability of the parts;
- Quantity per unit;
- Total quantity;
- Material specification;
- Unit price ex-works;
- Any other useful information.

Note:
Illustrated spare parts lists are preferred.

21.3.8 In the case of "bought-out items" the Supplier shall, in addition, specify:

- The drawing and part number of the original manufacturer.
- Where two or more parts can be supplied only as an 'assembly' the drawing/part number shall be given for the assembly.
- Spare parts lists shall illustrate the various parts with identification numbers and should include sectional drawings/parts list.

21.3.9 Precommissioning/commissioning spare parts shall mean the parts required to safeguard
the operation of equipment during the running-in and starting-in periods. These parts shall therefore be available on site prior to plant start-up.

21.3.10 Normal operational spare parts

Spare parts for normal operation should adequately cover the requirements of day to day maintenance for a period of two years operation following the commissioning (running-in and starting up periods).

21.3.11 The English language shall be used on all documents.

21.3.12 Each document shall contain the purchase order number, item number, and year of manufacture.

21.4 Time Schedule

The provisional time schedule as per clause 21.2.2. shall be finalized and dates for start of work, inspection and delivery shall be indicated.
APPENDICES

APPENDIX A

A.1 ELECTRICAL SUPPLY CONDITIONS FOR INSTRUMENT SYSTEMS

The following types of supply are defined:

A.1.1 AC uninterruptible maintained

An uninterruptible two feeder AC supply of a quality is suitable for the feeding of microprocessor based and computer systems.

A.1.2 This supply will be maintained typically for 30 minutes for process units and one hour for utilities unless otherwise specified. This type of supply should be applied for systems such as fire and gas detection, control and telecommunication, with back-up times as specified.

A.1.3 AC interruptible maintained

An AC supply with a two feeder arrangement backed up with an emergency supply, which may have an interrupt time of up to 10 seconds.

Note:

Unless additional measures are taken, the electrical characteristics of this supply are the same as for the mains supply. Additional measures could involve line conditioners and special transformers to stabilize voltage and reduce mains interference.

A.1.4 AC interruptible not maintained

Same as A.1.3, but without back-up, from an emergency power source.

A.1.5 DC uninterruptible maintained

A supply as specified in electrical power supply and distribution system standard IPS-E-IN-180, and maintained for a prolonged period such as for A.1.1 above.
A.2 SPECIFICATION FOR THE TYPES OF ELECTRICAL SUPPLY

TABLE 1 - TYPES OF SUPPLY

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<th>DESCRIPTION</th>
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<th>(1.3)*</th>
<th>(1.4)*</th>
<th>(1.5)*</th>
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<td>110</td>
<td>110</td>
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<td>Voltage Tolerance (+% max.)</td>
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<td>5 (Note 2)</td>
<td>5 (Note 2)</td>
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<tr>
<td>Frequency (Hz)</td>
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<td>50</td>
<td>50</td>
<td>---</td>
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<tr>
<td>Frequency Tolerance (+%max.)</td>
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<td>5</td>
<td>5</td>
<td>---</td>
</tr>
<tr>
<td>Harmonic (%max.)</td>
<td>5 Total</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Content (Note 4)</td>
<td>2 Each</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Ripple (%max.) (Note 3)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>2</td>
</tr>
<tr>
<td>Interrupt Time</td>
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<td>10 s</td>
<td>---</td>
<td>10 ms</td>
</tr>
<tr>
<td>Crest Factor (max.) (Note 4)</td>
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<td>---</td>
<td>---</td>
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<tr>
<td>In-Rush Current (Note 5)</td>
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<td></td>
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</tbody>
</table>

* See the previous page

Notes:

1) Voltage and frequency to suit local conditions, will be confirmed together with phase required, for each particular case (by Electrical Engineering).

2) As mains supply (statistical information, if required, shall be provided by Electrical Engineering).

3) Defined as root means square value of AC components/nominal DC voltage.

4) Defined as I(peak)/I(root mean square). Additional harmonics may be generated by the non-linear load, total should not exceed 5% and 2% for each component.

5) Defined as number of times the nominal current will be drawn during a defined time.

Typical figure could be: 20 × I (nominal), during 10 ms. The figure is to be confirmed for each particular case.
FIGURE 1
Simple Circuit

FIGURE 2
Series Mode

FIGURE 3
Common Mode