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Guidance on Practice for Wire and Cable

GP 12-15

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 12-15. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

Amoco (ACES)

A EL-WC-00E	Electrical—Wire and Cable—Engineering Specification
A EL-SYS-00-E	Electrical—System—Design Specification
A PC-COM-00-E	Process Control—Computer and Communication Systems—Specification

ARCO Products Company (APCES)

ES 313 89F	Instrument – Electrical
ES 400 89F	Electrical – General
ES 413 90F	Electrical Requirements for Mechanical Equipment
ES 401 90F	Electrical Grounding

British Petroleum (RPSE)

RP 12-13	Electrical Systems and Installations, Cables, Cable Systems and Wiring
RP 24-1	Fire Protection - onshore
RP 24-2	Fire Protection - offshore
RP 30-1	Instrumentation and Control Design and Practice
GS 112-1	Electrical Engineering Specification for Materials and Workmanship
GS 112-12	Requirements for Flame Retardant and Fire Resistant Cables

BP Chemicals (CP)

CP 16-1-25	Instrument Cable
CP 16-1-26	Fire Resistant Instrument Cable
CP 17-1-1	Power System Design Practices
CP 17-2-1	Electrical Detail Design and Construction Practice
CP 17-13-1	Electrical Standards for Packaged Equipment

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1. Scope

This GP document provides guidance for the design, application, and installation of wire and cable.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP Engineering Technical Practices (ETP)

GIS 12-151	Guidance on Industry Standard for Low Voltage Power cable (IEC)
GIS 12-152	Guidance on Industry Standard for Low Voltage Power Cable (ANSI)
GIS 12-153	Guidance on Industry Standard for High Voltage Power Cable (IEC)
GIS 12-154	Guidance on Industry Standard for High Voltage Power Cable (ANSI)
GIS 12-155	Guidance on Industry Standard for Instrumentation Cable (IEC)
GIS 12-156	Guidance on Industry Standard for Instrumentation Cable (ANSI)
GIS 12-157	Guidance on Industry Standard for Optical Fibre Cable (IEC)
GIS 12-158	Guidance on Industry Standard for Optical Fibre Cable (ANSI)
GP 12-02	Guidance on Practice for Power System Installation and Construction
GP 12-30	Guidance on Practice for Lighting & Small Power
GP 12-55	Guidance on Practice for Inspection & Testing of Electrical Systems
GP 12-60	Guidance on Practice for Hazardous Area Electrical Installations
GP 12-65	Guidance on Practice for Electromagnetic Compatibility
GP 12-75	Guidance on Practice for Cable Tray and Conduit

Engineering Equipment and Materials Users Association (EEMUA)

EEMUA Publ. 133	Underground armoured cable protected against solvent penetration and corrosive attack.
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Insulated Cable Engineers Association (ICEA)

S-93-639	Standard for Shielded Power Cables Rated 5-46kV for the distribution of Electrical Energy (NEMA WC 74)
S-95-658	Standard for Non-shield Power Cable Rated 2000 Volts or Less for the Distribution of Electrical Energy (NEMA WC 70)
T-29-520	Conduction Vertical Cable Tray Flame Tests with Theoretical Heat Input Rate of 210,000 B.T.U./Hour

International Electrotechnical Commission (IEC)

IEC 60055-1	Paper-insulated metal sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas-pressure and oil-filled cables) Part 1: tests on cables and their accessories
IEC 60092-350	Electrical installation in ships — Part 350: Shipboard power cables — General construction and test requirements



IEC 60092-352	Electrical installation in ships — Part 352: Choice and installation of cables for low-voltage power systems
IEC 60092-353	Electrical installation in ships — Part 353: Single and multicore non-radial field power cables with extruded solid insulation for rated voltages 1 kV and 3 kV
IEC 60092-354	Electrical installation in ships — Part 354: Single- and three-core power cables with extruded solid insulation for rated voltages 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)
IEC 60183	Guide to the selection of high-voltage cables
IEC 60227-1	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 1: General requirements
IEC 60331-12	Test for electrical cables under fire conditions-circuit integrity-Part 12: Apparatus-fire with shock at a temperature of at least 750 degrees Celsius
IEC 60332-3	Tests on cables under fire conditions — Part 3: Tests on bunched wires or cables.
IEC 60364-5-52	Electrical installations of buildings — Part 5-52: Selection and erection of electrical equipment – Wiring systems
IEC 60502-1	Power cables with extruded insulation and their accessories for rated voltages of 1 kV ($U_m = 12$ kV) up to 30 kV ($U_m = 36$ kV) — Part 1: Cables for rated voltages of 1 kV ($U_m = 1.2$ kV) and 3 V ($U_m = 3.6$ kV)
IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages of 1 kV ($U_m = 12$ kV) up to 30 kV ($U_m = 36$ kV) — Part 2: Cables for rated voltages from 6 kV ($U_m = 7.2$ kV) up to 30 kV ($U_m = 36$ kV)
IEC 60702-1	Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V — Part 1: Cables

Institute of Electrical and Electronic Engineers (IEEE)

Std 576	Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
Std 1242	Guide for Specifying and Selecting Power, Control, and Special-Purpose Cable for Petroleum and Chemical Plants

National Fire Protection Association (NFPA)

NFPA 70	National Electric Code
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Underwriters Laboratories (UL)

UL 1277	Type TC Power and Control Tray Cable
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3. Power cable

3.1. General selection information

- a. Standard voltage ratings selected from IEC 60038 and in accordance with the applicable cable manufacturing standard should be specified.

IEC 60038 defines standard voltages for 50Hz and 60Hz systems.

If power systems involve no neutral earth connection or are impedance earthed the cable voltage specification needs to ensure that the phase to earth capability is suitable for line voltage. This is because under earth fault conditions the phase to earth voltage could be equal to line voltage. If this may last for fractions of a second, because of protection arrangements, then this requirement may be relaxed.

- b. Power cables should be selected in accordance with their suitability for application and operating environment. Following is a listing of available power cable insulation compounds. Cable selection should match insulation type with application and operational environment.
1. PVC insulated, extruded PVC inner sheath, galvanised steel wire armoured, PVC outer sheath fabricated in accordance with IEC 60502-1.
 2. PVC insulated, extruded PVC inner sheath, galvanised steel wire armoured, PVC outer sheath, in accordance with IEC 60502-1 with the addition of a lead sheath over the inner extruded PVC sheath and an additional extruded PVC bedding between lead sheath and armour (EEMUA Publ. 133 details this type of construction).
 3. PVC or elastomer insulated wiring cables in accordance with IEC 60227-1, for use in conduit/trunking or as earthing/grounding conductor.
 4. PVC, EPR or XLPE insulated, PVC or CSP inner sheath, galvanised steel or copper alloy braid armour, PVC or CSP outer sheath, in accordance with IEC 60092-350, IEC 60092-353 or IEC 60092-354.
 5. EPR or cross-linked polyethylene (XLPE) insulated, galvanised steel wire or tape armoured, PVC outer sheath, in accordance with IEC 60502-1 and IEC 60502-2.
 6. Mineral insulated copper sheathed cable (MICC) in accordance with IEC 60702-1, or similar national standard.
 7. Paper insulated, mass impregnated non-draining, lead covered steel wire or tape armoured, PVC outer sheath, in accordance with IEC 60055-1.
 8. EPR or XLPE insulated, unshielded or copper tape shielded cables in accordance with ICEA S-93-639.
 9. NEC type TC cable in accordance with UL 1277.
 10. NEC type MC cable in accordance with ICEA S-95-658.
- c. Wire and cable should be sized to operate within their current carrying capacity and as determined by maximum continuous insulation temperature.

Refer to Table 1 below for general guidance on conductor temperature limitations.

