



INTRODUCTION

Instrumentation and Control cables are designed to carry signals from instrumentation and control equipment. The cables comply with one of the following standards:

- BS5308 / PAS5308 Part 1 or 2 - British standard
- EN 50288-7 - European standard
- NF M87-202 - French standard



BS 5308 AND PAS 5308

British Standard BS 5308 has actually been withdrawn and superseded by the European standard EN 50288-7 but is still commonly specified, and is often supplied under the Publicly Available Standard (PAS) equivalent.

The standard is split into two parts and then at least 2 Types (there is also a Type 3 with a Lead Sheath);

Part 1 covers Polyethylene and Cross-linked Polyethylene insulated cables

Part 2 covers PVC insulated cables

Type 1 covers cables both screened and unscreened

Type 2 covers cables that include a Steel Wire Armour (SWA)

Why do people still use PAS5308? The European standard BS EN 50288-7 doesn't necessarily adequately cover certain constructions, higher voltage ranges, and dimensions. It should be noted that a PAS does not hold the same weight as a BS though.

The cables are suitable for operation at 300/500V and have Class 2 stranded or Class 5 flexible stranded Copper conductors. They're not designed for direct connection to a low impedance source, such as the public electricity supply.

Identification colour coding

Constructions of up to 50 Pairs are either colour-coded as per the table from Annex C of the standard (on page 4 of this document) or black/white or black/blue and numbered. Triples are not included in the BS5308 standard so colour coding is not defined (although is often black/white/red numbered).

EN 50288-7

This European Standard was first published in 2005 and superseded BS5308 and other national types to harmonise instrumentation cable standards. The Scope is defined as: '... multi-element cables suitable for connecting instruments and control systems for analogue or digital signal transmission. They may or may not be screened and optionally may incorporate armouring and/or moisture or environmental protection layers.'. The standard specifies the requirements for the various elements that make up the cables but does not prescribe particular construction types. Cables covered by this standard have maximum rated voltages of 90V, 300V and 500V a.c.

Naming Convention

EN 50288-7 cables are often referred to by the following coding:

RE: Designation for instrumentation cables
 Ym: PVC high temperature
 Yo: PVC sheath with improved oil resistance
 2Y: Polyethylene (PE)
 2X: Cross linked polyethylene (XLPE)
 T or MGT: Mica glass tape
 H: Low smoke zero halogen
 2G: Silicone rubber
 St: Overall screen

PSCR: Pairs screened
 OSCR: Over all screened
 PIMF: Pairs in metal foil
 TIMF: Triples in metal foil
 C: Copper wire braid
 Q: Steel wire braid
 SWA: Steel wire armour
 B: Flat steel tape armour
 FG: Flat steel wire helix

M: Lead sheath
 Mz: Lead alloy sheath
 (L)2Y: Multilayer sheath
 (L)2Y4Y: ALNYC sheath
 (f): Increased fire resistance
 CI: Circuit integrity

For example: RE-2X(st)Y SWAY PiMF are instrumentation cables with XLPE insulation, Overall screen, PVC inner sheath, SWA armour, PVC outer sheath. The pairs are also individually screened in metal foil (underneath the overall screen).



Identification colour coding

Unless otherwise specified (e.g. by means of numbered cores or tapes), the coding for identification shall correspond with the standard colours shown in HD 402 S2. Coloured or numbered non-hygroscopic binder tapes may be applied over screened cabling elements as identification.

NF M 87-202 PETROLEUM INDUSTRY, INSTRUMENTATION CABLES

French National Standard cable for armoured or unarmoured instrumentation cables in pairs, three core, four core, multiple pairs and multiple three core (multiple pairs are used for multiple four core cables). Coloured or numbered non-hygroscopic binder tapes may be applied over screened cabling elements as identification. These cables are used in extra-low voltage applications in petroleum and petrochemical units for the transmission of a.c and d.c analogue signals.

Construction

Class 1 solid or Class 2 stranded Copper conductors (unlike EN 50288-7 which offers Class 5 flexible stranded as well), with PVC insulation, although other materials such as XLPE or Silicone Rubber may be agreed. The major difference is in the armouring, which uses a dual layer of steel tape (STA) as opposed to SWA, a waxed crepe paper separator, and the use of a PVC sheathing that is of a type resistant to the aromatic hydrocarbons found in the petrochemical industry.

Cable type coding system for cables to NF M87-202 uses a 10 character alpha numeric system. The characters are in pairs or series of two, see table below:

CODE	MEANING OF CODE
Two figures	1st series - Numbers of pairs, three cores, four cores Pairs: 01, 03, 07, 12, 19 and 27 Three cores: 01, 07, and 12 Four core: 01
Two letters	2nd Series - Type/Use Paired series copper IP Three core series: copper IT Four core series: copper IQ
Two figures	3rd series - composition of conductors Single core pair, three core, four core: (7x 0.40 - cross sectional area 0.88mm ²) 09 Multiple pairs and three cores: (1 x 0.8mm-cross sectional area 0.5mm ²) 05
Two letters	4th series - screen (Screening) General screen EG Individual screen and general screen EI Individual screen per half cable + general screen EP
Two letters	5th series - Mechanical protection No strip - limited mechanical protection, delivery at stage of PVC sheathing which is resistant to aliphatic hydrocarbons, = SF Steel Strip - mechanical protection and PVC sheath for resistance with lead and PVC sheathing for resistance to aromatic hydrocarbons = PF Special sheath and steel strip for mechanical and chemical resistance to Aromatic hydrocarbons without lead, = TF

(1) If multiple pairs or multiple three cores cables are connected to equipment subject to heavy vibration, more flexible cables should be used.

Coding system

A star to be used where cross linked polyethylene is used instead of PVC by agreement with Purchaser.

Identification colour coding

Single pair cable: ● Natural, ● Red (or ● Blue or ● Yellow)

Single three core cable: ● Natural, ● Red, ● Blue

Single quad core cable: ● Natural, ● Red, ● Blue, ● Yellow

Multipair and multi three core cables;

The individual pairs: ● Natural, ● Red

The individual three core cables are: ● Natural, ● Red, ● Blue



Identification between pairs and three core cables shall be obtained by numbering with the numbers printed in accordance with NF C 30-201 either:

- On the natural member or
- On the PVC sheath of each pair or each three core cable

Some common materials used in instrumentation cables (and why)

PVC: Polyvinylchloride is used as either an insulation material or as a sheathing material. PVC is a highly versatile material which has traditionally been used extensively across the cable industry. It is flame retardant and self-extinguishing. It can be modified for a variety of applications including indoor and outdoor use, in wet and dry conditions, in conduit or direct burial and for both high and low temperature application. PVC also has resistance to a wide range of chemicals including some oils and solvents. PVC is replaced in certain applications by low smoke, halogen free materials, where there is a substantial risk to life and equipment in a fire situation.

PE: Polyethylene is used as either an insulation or sheathing material. It has excellent chemical resistance, including oils and extremely low water absorption. It also has superior mechanical strengths and good low temperature resistance. PE cables tend to be somewhat more rigid due to the hardness of the PE material and are not flame retardant. Due to the flammability the PE sheathing is generally used with cables for outdoor applications or for direct burial.

XLPE: Cross-linking PE improves the performance of the cable, increasing the temperature and chemical resistance. This material is used mainly as an insulation material.

LSZH: Low smoke zero halogen materials are used in place of PVC materials where there is a significant risk to life and equipment in fire situations. These cables do not produce halogen acid gases when they burn and do not release the significant levels of dense black smoke that the PVC equivalent materials would in the event of a fire. Various additives can be added to these materials to improve resistance to chemicals including oils and solvents.

Silicone rubber is used in applications where there is a need for extended temperature ranges, suitable for applications from -90°C to 180°C. Silicone rubber is also used widely where cables are required to maintain circuit integrity under fire conditions.

Mica Tape: Glass backed mica tape is extensively used in fire resistant cables due to its exceptional performance as an insulation material in a fire situation.

SWA: Steel wire armouring is used to offer a significant degree of resistance to mechanical impact. It is composed of either round steel galvanised wires or flat steel galvanised wires helically wound around the bedding covering the insulated conductors.

Single or double layer of metal tape. Metal tape of either steel or brass is longitudinally wrapped around the bedding covering the insulated cores. This cable whilst offering a tough tight covering seal over the cores is also somewhat less flexible than the SWA version. Tapes offer the most complete covering. The steel tapes provide the best inductive protection whereas the brass tapes are most frequently used as rodent protection.

Metal Braid: The braid is either galvanised steel or plain or tinned copper wires. Braiding these fine wires makes the cable more flexible and lightweight than the other means of mechanical protection, SWA and metal tapes.

Lead or Lead alloy sheath: Lead sheathing offers the best protection against oils and chemicals and essential where there is constant exposure in heavily polluted mud with hydrocarbon content. Lead alloy is a lighter alternative to the chemical barrier offered by lead, it is frequently used in areas of high vibration



Annex C - BS5308 / PAS5308

Table C.1 Identification of cable pairs other than two-pair cables without individual pair screens (quads)

NO. OF PAIRS	A-WIRE	B-WIRE	NO. OF PAIRS	A-WIRE	B-WIRE
1	Black	Blue	26	White	Yellow
2	Black	Green	27	Red	Yellow
3	Blue	Green	28	Orange	Yellow
4	Black	Brown	29	Black	Grey
5	Blue	Brown	30	Blue	Grey
6	Green	Brown	31	Green	Grey
7	Black	White	32	Brown	Grey
8	Blue	White	33	White	Grey
9	Green	White	34	Red	Grey
10	Brown	White	35	Orange	Grey
11	Black	Red	36	Yellow	Grey
12	Blue	Red	37	Black	Voilet
13	Green	Red	38	Blue	Voilet
14	Brown	Red	39	Green	Voilet
15	White	Red	40	Brown	Voilet
16	Black	Orange	41	White	Voilet
17	Blue	Orange	42	Red	Voilet
18	Green	Orange	43	Orange	Voilet
19	Brown	Orange	44	Yellow	Voilet
20	White	Orange	45	Grey	Voilet
21	Red	Orange	46	Black	Turquoise
22	Black	Yellow	47	Blue	Turquoise
23	Blue	Yellow	48	Green	Turquoise
24	Green	Yellow	49	Brown	Turquoise
25	Brown	Yellow	50	White	Turquoise