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PERSONNEL SAFETY PROTECTIVE EQUIPMENT

(PROJECT STANDARDS AND SPECIFICATIONS)

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SCOPE

This Project Standard and Specification specifies the minimum requirements for types, classes, materials, design, physical and performance that afford protection to all body members of the wearer in industrial plants. It is formed to cover a separate section for each group of protective clothing.

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.

1. **ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)**

   ANSI 89.1 (1986) "Protective Headwear for Industrial Workers Requirements"
   ANSI Z41.1 (1986) "Personnel Protective Footwear"

2. **BSI (BRITISH STANDARDS INSTITUTION)**

   BS 5240 (1987) "Industrial Safety Helmets"
   Part 1 "Specification for Construction and Performance"
   BS 6489 "Headforms for Use in the Testing of Protective Helmets"
   BS 679 (1977) "Specification for Filters for Use During Welding and Similar Industrial Operations"
   B S 1542 (1982) "Equipment for Face and Neck Protection Against Non Ionizing Radiation Arising During Welding and Similar Operations"
   BS 2092 (1987) "Eye Protectors for Industrial and Non Industrial Uses"
   BS 2724 (1987) "Sun Glare Eye Protectors for General Use"
   BS 2738 (1989) "P.2 Spectacle Lenses"
   "Specification for Tolerances on Optical Properties of Uncut Finished Lenses"
   BS 3199 (1972) "Method for Measurement of Spectacles Including a Glossary of Terms"
   BS 903 "Method of Testing Vulcanized Rubber Part A2. Determination of Tensile Stress-Strain Properties. Part A 19 Heat Resistance and Accelerated Air Aging Tests. Part

	A 38 Determination of Dimensions of Test Pieces and Products for Test Purposes"
BS 1651 (1986)	"For Industrial Gloves"
BS 2471 (1984)	"Methods of Test for Textiles-Woven Fabrics-Determination of Mass"
BS 3144	"Methods of Sampling and Physical Testing of Leather"
BS 5108 (1982) (ISO 4869: 1981)	"Method for Measurement of Sound Attenuation of Hearing Protectors"
BS 6344 (1988) (Parts 1 and 2)	"Industrial Hearing Protectors"
BS 5145 (1989)	"Lined Industrial Vulcanized Rubber Boots"
BS 5451 (1977)	"Electrically Conducting and Antistatic Rubber Footwear"
BS 2576 (1986)	"Method for Determination of Breaking Strength and Elongation (Strip Method) of Woven Fabrics"
BS 3870	"Stitches and Seams"
BS 3870 Part (1) (1991)	"Classification and Terminology of Stitch Types"
BS 3870 Part (2) (1991)	"Classification and Terminology of Seam Types"
BS 6629 (1985)	"Specification for Optical Performance of High Visibility Garments and Accessories for Use on the Highway"
BS 903 (1987)	"Methods of Testing Vulcanized Rubber"
Part A-16	"Determination of the Effects of Liquids"
BS 2576	"Method for Determination of Breaking Strength and Elongation (Strip Method) of Woven Fabrics"
BS 3084 (1981)	"Specification for Solid Fasteners"
BS 3424	"Testing Coated Fabrics"
Part 7, Method 9	"Method for Determination of Coating Adhesion Strength"
BS 3546	"Coated Fabrics for Water Resistant Clothing"
Part 1:	"Specification for Polyurethane and Silicone Elastomer Coated Fabrics"
Part 2:	"Specification for PVC Coated Fabrics"
Part 3:	"Specification for Natural Rubber and Synthetic Rubber Polymer Coated Fabrics"
BS 4724 (1986)	"Resistance of Clothing Materials to Permeation by Liquids"
Part 1 (1986)	"Method for the Assessment of Breakthrough Time"
Part 2 (1988)	"Method for the Determination of Liquid Permeating after Breakthrough"

BS 5438 "Methods of Test for Flammability of Vertically Oriented Textile Fabrics Assemblies Subjected to a Small Igniting Flame"
BS 6249 "Materials and Material Assemblies Used in Clothing for Protection Against Heat and Flame"
Part 1: "Specification for Flammability Testing and Performance"
BS 2092 (1987) "Specification for Eye Protectors for Industrial and Non-Industrial Uses"
BS 2723 (1988) "Specification for Firements Leather Boots"
BS 5145 (1984) "Specification for Lined Industrial Vulcanized Rubber Boots"

3. **ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)**

ISO 4850 (1979) "Personal Eye-Protectors for Welding and Related Techniques Filter-Utilization and Transmittance Requirement"
ISO 4851 (1979) "Personal Eye Protectors-Ultra-Violet Filters-Utilization and Transmittance Requirement"
ISO 4852 (1978) "Personal Eye Protectors-Infra-Red Utilization and Transmittance Requirement"
ISO 4855 (1981) "Personal Eye Protectors-Non Optical Test Methods"
ISO 2251 (1975) E "Lined Antistatic Rubber Footwear"
ISO 6530 (1990) "Protective Clothing-Protection Against Liquid Chemical-Determination of Resistance of Materials to Penetration by Liquids"

4. **JIS (JAPANESE STANDARD INSTITUTE)**

JIS T 8103 (1983) “Anti-Electrostatic Footwears With/Without Safety Toes"
JIS S 5037

5. **ASTM (AMERICAN STANDARD FOR TEST OF MATERIAL)**

ASTM D 2582-67 "Standard Test Method for Puncture Propagation Tear Resistance of Plastic (1984) Films and Thin Sheeting"

6. **NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)**

1971(2000) "Standard on Protective Ensemble for Structural Fire Fighting"
1975(2005) "Standard on Station/Work Uniform Fire and Emergency Services"

DEFINITIONS AND TERMINOLOGY

Head Protection

Brim - An integral part of the shell extending outward over the entire circumference.

Chin strap - An adjustable strap that fits under the chin to secure the helmet to the head.

Crown straps - The part of the suspension that passes over the head.

Harness - The complete assembly by means of which the helmet is maintained in position on the wearer's head.

Headband - The part of the harness that encircles the head.

Helmet - A device that is worn to provide protection for the head, or portions thereof, against impact, flying particles, electric shock, or any combination thereof; and that includes a suitable harness.

Nape strap - A strap that fits behind the head to secure the helmet to the head; it may be an integral part of the headband.

Peak - An integral part of the shell extending forward over the eyes only.

Protective padding - A material used to absorb the kinetic energy of impact.

Shell - A helmet without its harness, accessories, and fittings.

Suspension - The portion of the harness that is designed to act as an energy-absorbing mechanism. It may consist of crown straps, protective padding, or a similar mechanism.

Sweatband - The part of the headband, whether integral or replaceable, that comes in contact with at least the wearer's forehead.

Winter liner - A sung-fitting cover worn under the helmet to protect the head, ears, and neck from cold.

Eye Protection and Face Protection

Backing lens - A transparent plate used between the eye and the welding filter.
Note: The terms' chipping lens' and 'rear cover plate' are also used in practice.

Basic eye-Protector - An eye-protector that satisfies the minimum requirements, but does not give the additional protection detailed in the following 5 Clauses:

- Impact eye-protector
  An eye-protector able to withstand the impact test to grade 1 or grade 2 and providing lateral protection to the orbital cavities. Grade 1 impact eye-protectors are able to withstand a velocity of impact of 120 m/s, and grade 2 are able to withstand 45 m/s.
- Molten metals eye-protector
  An eye-protector that provides protection against molten metal splash and hot solids.
- Gases eye-protector
  An eye-protector that provides protection against gases and vapors.
- Dusts eye-protector
  An eye-protector that provides protection against dusts.
- Liquids eye-protector
  An eye-protector that provides protection against splashes or droplets of liquids.

Cover lens - A transparent cover used in front of the welding filter as a protection against welding splatter, etc.
Note: The terms 'filter cover' and 'cover plate' are also used in practice.

Dark shade - Shade number corresponding to the minimum value of luminous transmittance ôd. (see BS. 679).

Dual shade filter - A type of welding filter, part of which is made in a lighter shade and allows the welder to set up the work with a helmet or headshield in position before starting the welding operation; during welding the welder views the process through the darker part of the filter.

Eye-protector - Any form of eye-protective equipment covering at least the region of the eyes.

Face screen - An eye-protector covering all or a substantial part of the face.
Note: Also known as 'face shield' or 'visor'.

Face shield - A device worn in front of the face to give protection to the eyes, face and throat. It is either made of the material of the filter itself or is fitted with the filter(s) and, when provided, the filter cover(s).

Filter - The part of an eye protector through which a wearer sees and that is designed to reduce the intensity of incident radiation.

Goggles - An eye-protector fitted with a single or two separate oculars enclosing the orbital cavities.

Gradient filter - A filter used in sun glare spectacle in which luminous transmittance changes progressively in the vertical meridian, when the filter is mounted, over some or all of the filter.

Hand shield - A device held in the hand to give protection to the eyes, face and throat. It is fitted with filter(s) and, where provided, filter cover(s).

Helmet - A device supported on the head to give protection to the face, ears and throat and part of the top of the head. It is fitted with filter(s) and, where provided, filter cover(s).

Housing - The part of the equipment that supports the filter(s), filter cover(s) and backing lens.

Light shade - Shade number corresponding to the maximum value of luminous transmittance ôL. (see BS 679).

Liquid droplets - Very small mass particles or a liquid substance capable of remaining in suspension in gas.

Neck shield - An article of protective clothing that, when fitted to a helmet, affords protection from reflected radiation to the back and sides of the head and neck.
Note: The design may include an extension to cover the lower part of the throat.

Ocular - The transparent part of the eye-protector that permits vision, for example, lens, visor, screen.

Orbital cavities - The apertures in the skull in which the eyes and their appendages sit.

Photochromic Filter - A filter used on sun glare spectacle that reversibly alter its luminous transmittance under the influence of sunlight.

Polarizing filter - A filter used on sun glare spectacle in which the transmittance is dependent on the amount and orientation of the polarization of the incident radiation.

Spectacles - An eye-protector, the oculars of which are mounted in a spectacle-type frame, with or without side shields. Mounted oculars include lenses integral with the frame.

Welding goggles - Is a device enclosing 3 space in front of the eyes into which radiation arising from welding can penetrate only through filter(s) and, where provided, filter cover(s).
Note: Goggles are usually held in position by a headband.

Variable shade Filter - A filter in which the transmittance varies in response to the incident light intensity, so enabling the user to set work with the filter in position and with a satisfactory view; on striking the arc the luminous transmittance decreases and the device acts as a conventional welding filter. The process reverses when welding stops.
Note: The variable transmittance is usually achieved by means of an integral electronic circuit with a built-in power supply.

Variable shade window - A device that enables observation of the workpiece before the welding arc is ignited and that automatically changes its shade number from a light shade to a dark shade when the welding arc is ignited.
Note: A variable shade window is used only in combination with a welding filter which complies with this Standard.

Hand Protection

Clute patterns - A four-finger and thumb design, having one-piece palm, including the fronts of all four fingers and a separate cuff [see Fig. 1(a)]. The back comprises three of four separate pieces of material.

Cuff - The extension on a glove or mitt which covers the wrist (examples are shown in Fig. 2).

Flock lined (rubber or PVC) gloves - Gloves which have their inner surface covered in a layer of pure cotton fibers, anchored into the rubber of PVC during manufacture. These absorb perspiration and help to keep the hands cool during

use in a warm environment; conversely, they contribute to warmth when used in a cold application.

Gauntlet - A type of glove which, relative to the wrist glove, provides additional protection for the wrist and part of or the whole of the arm.

Gunn pattern - A four-finger and thumb design, having the face of the thumb, the palm, and first (index) and fourth (little) fingers made of one or two pieces of material. The back is of one piece up to the cuff and includes the back of the four fingers at least. The fronts of the second and third fingers may be one piece each, jointed to the palm at the base of the appropriate fingers [see Fig. 1(b)]. The back of the glove may be jointed.

Mitt - A covering for the hand and wrist, having a separate thumb and a common covering for the fingers.

Montpelier pattern - A four-finger and thumb design, having the palm and the fronts of all four fingers in one piece, and the back of the glove and the backs of all four fingers in one piece. This pattern has a fourchette between the fingers (see Fig. 1(c)).

One-Finger mitt - A covering for the hand and wrist, having a separate thumb and forefinger and a common covering for the remaining fingers.

Wrist glove - A wrist length glove providing covering for the hand and wrist, having separate fingers.

Wristing - Additional fitment attached to the main body of the glove at the open cuff end to present a close fit to the wrist of the wearer.

Basic Patterns

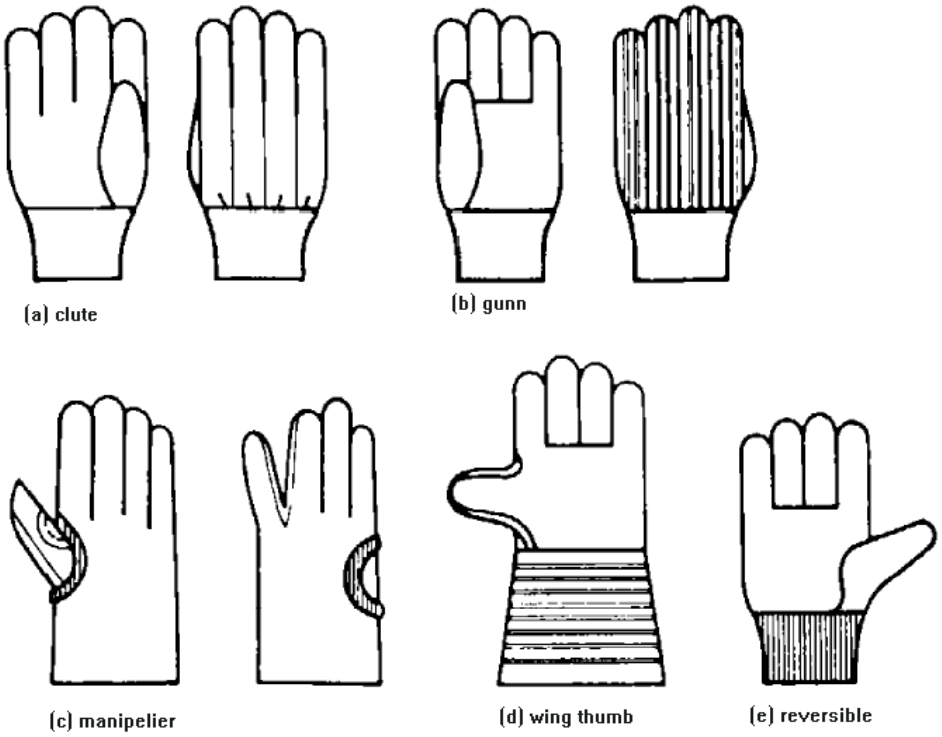

Fig. 1 - Glove Patterns

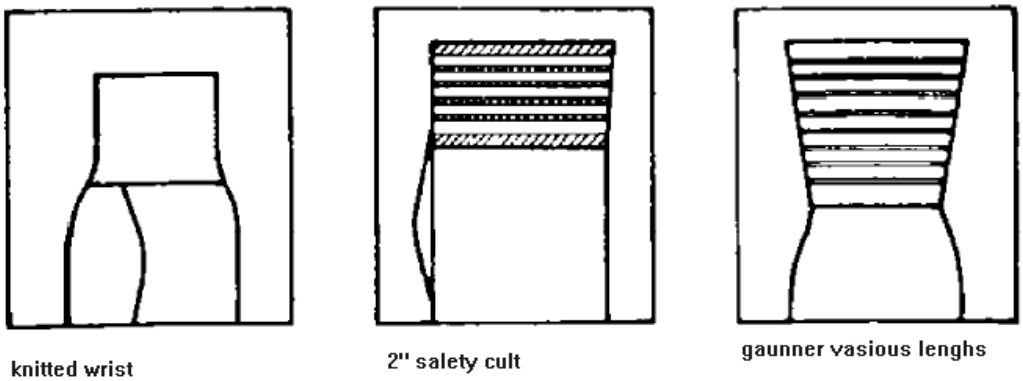

Fig. 2 - Cuff Patterns

Ear Protection

Acoustic Test Fixture (ATF) - A device that approximates certain dimensions of an average adult human head and is used for measuring the insertion loss of ear muffs. For this purpose it includes a microphone arrangement for measuring sound pressure levels.

Attenuation - The algebraic difference in dB between the 1/3 octave band pressure level, as perceived by a real ear at threshold in a specified sound field under specified conditions, with the hearing protector absent and the sound pressure level with the hearing protector being worn, with other conditions identical.

Cup - A hollow, approximately hemispherically shaped component which is mounted on the headband and to which a cushion and a liner are usually fitted.
Note: In this context, a cup is sometimes referred to as a shell.

Cushion - A deformable cover, usually foam plastics or liquid filled, fitted to the rim of the cup to improve the comfort and fit of the ear muffs on the head.
Note: In this context, a cushion is sometimes referred to as a seal.

Decibel (dB) - One-tenth of a bel, a scale unit used in comparison of the magnitude of powers. The number of bels, expressing the relative magnitudes of two powers, is the logarithm to the base 10 of the ratio of the powers.

Ear Muffs - A hearing protector, either fitting over and enclosing the pinna and sealing against the side of the head (circumaural) or sealing against the pinna (supraaural). Over-the-head, and ear muffs are designed to be worn with the headband passing over the top of the head and behind the head respectively. A head strap supports behind-the head ear muffs by being in contact with the top of the head. Universal ear muffs can be worn in either mode.

Ear Plugs - A hearing protector inserted and worn in the ear canal or in the ear cavity.

- Disposable
  Intended for one fitting only.
- Reusable
  Intended for more than one fitting.
- Sonic ear plug
  Insert tipe ear protector utilizing a moving diaphragm, that attenuate harmful high level noises without blocking normal background sound.

Head band - A band, usually of metal or plastics, designed to enable the ear muffs to fit securely around the ears by exerting pressure through the cushions.

Head strap - A flexible strap fitted to each cup, or the headband close to the cup. It can be adjusted to support the ear muffs, usually behind-the-head types, by fitting closely to the top of the head.

Helmet - A device covering a substantial part of the head and generally having functions other than, or in addition to, hearing protection.

Head width - Maximum width of head when subject is sitting erect (see Fig. 3).

Head height - Vertical distance between tragus and top of head when subject is sitting erect (see Fig. 3).

Head depth - Horizontal distance between tragus and vertical line through back of head when subject is sitting erect (see Fig. 3).

Insertion loss - The algebraic difference in dB between the 1/3 octave band pressure level, measured by the microphone of the acoustic test fixture in a specified sound field under specified conditions, with the hearing protector absent and the sound pressure level with the hearing protector on, with other conditions identical.

Liner - Material contained within the cup which can increase the attenuation of the ear muffs at certain frequencies.

Pin noise - Noise whose sound pressure spectral density is inversely proportional to frequency, i.e., equal energy in each 1/3 octave band.