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KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	<b>FIRE-FIGHTERS PERSONAL PROTECTIVE EQUIPMENT</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	

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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

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	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)	"Method for Measurement of Sound Attenuation of Hearing Protectors"
(ISO 4869: 1981)	
BS 6344 (1988)	"Industrial Hearing Protectors"
(Parts 1 and 2)	
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	"Classification and Terminology of Stitch Types"
Part (1) (1991)	
BS 3870	"Classification and Terminology of Seam Types"
Part (2) (1991)	
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"

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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"
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### 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"

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## DEFINITIONS AND TERMINOLOGY

**Moisture barrier** - The component layer designed to prevent the transfer of liquid, water form the environment to the thermal Barrier.

**Trim** - Retroreflective and fluorescent material permanently attached to the outer shell for visibility enhancement.

**Flame resistance** - The property of a material whereby flaming combustion is prevented, terminated, or inhibited following application of a flaming or non-flaming sources of ignition, with or without subsequent removal of the ignition sources. Flame resistance can be an inherent property of the textile material, or it may be imparted by specific treatment.

## UNITS

This Standard is based on International System of Units (SI) except where otherwise specified.

## FIRE-FIGHTERS PROTECTIVE CLOTHING (HELMET, FOOTWEAR AND GLOVES)

### General

1. The hazards to be expected in condition of heat particularly in fire fighting are:
  - The effect of heat on the body, face and hands;
  - The danger of clothing catching fire;
  - The effect on the lungs due to combustion products and vapor used for fire extinction;
  - Reduced visibility owing to smoke and lighting failure;
  - Electric shock;
  - Falling objects;
  - The effect of high rates of heating by conduction caused in contact with hot surface;
  - Falling and slipping.

Because of the diverse nature of these hazards, the protective clothing specified in this Project Standard and Specification should be worn by fire fighters and being aware of the limitations of the clothing.

2. Manufacturers of protective clothing data requirement

The requirements of this Standard shall provide a written statement that the protective clothing produced by manufactures meets or exceed the

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requirement of this Project Standard and Specification. The manufacturer shall furnish upon request the laboratory data showing individual values upon which the statement is based.

3. The manufacturer shall provide on request, guidelines for maintenance, inspection and retirement.

### **Garment Requirement**

The garment shall consist of a composite of an outer shell, moisture barrier, and thermal barrier.

Protective garments shall have a means of securing moisture barrier, thermal barrier to the outer shell.

The garment including the front closure, shall be constructed in a manner that provides secure and complete moisture and thermal protection. If non-positive fasteners such as snaps or hook and pile tape are used in garment closures, a positive locking fastener such as hooks and dees (D'S) or zippers shall also be utilized.

Cargo pockets where provided shall have a means of drainage of water and shall have flaps with a means of fastening them in closed position.

Trim to be utilized to meet visibility, requirement and shall not be less than 50 mm wide and shall have retroreflective and fluorescent surface.

### **Labeling Requirements**

Protective garment applicable to this Project Standard and Specification shall be labeled, with the following:

- a. The outer shell of each protective garment shall have a label permanently and conspicuously attached to the inside upon which at least the following informations are printed.

Outer shell, moisture barrier, and thermal barrier must be utilized and all garment closures must be fastened when in use. Do not keep this garment in direct contact with flame or molten metal. Do not use for proximity or fire entry application or protection from chemical, radiological or biological agents. Use extreme care for all emergency operations.

- b. Manufacturers name and address.
- c. Country of manufacture.
- d. Manufacturers garment identification number.
- e. Date of manufacture.
- f. Size.
- g. Cleaning and drying instructions.

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**Additional Requirements for Protective Coats**

1. Protective coats shall provide protection as specified to the upper torso, neck, arms and wrists including hands and head.
2. Protective coat hardware shall not penetrate through the outer shell moisture barrier, and thermal barrier to contact the wearer's body when the coat is worn covered by external closure flaps.
3. Each protective coat sleeve shall have a resilient wristlet.
4. Protective coats shall have a composite collar not less than 100 mm. in height at any point with a closure system. Collar and closure system shall consist of an outer shell, moisture barrier, and thermal barrier that meet all performance requirements as specified in performance requirement of this Project Standard and Specification.
5. Protective coat trim configuration shall include a circumferential band around the coat and each wrist.
6. Protective coat trim shall have not less than 2000 sq cm of fluorescent area.
7. Protective coat trim shall include not less than 800 sq cm of fluorescent area visible from the front and 800 sq cm of fluorescent area visible from the rear when the garment is properly closed and is laid on a flat inspection surface.

**Additional Requirements for Protective Trousers**

Protective trousers shall provide protection as specified to the lower torso and legs, excluding the ankles and feet.

The thermal barrier of the protective trousers may be configured as a protective uniform pant. When configured in this manner, the protective uniform pant component shall meet all requirements for thermal barriers and the entire protective trousers with outer shell, moisture barrier, and protective uniform pant as the thermal barrier assembled shall meet the requirements specified in this Project Standard and Specification.

Protective trousers hardware shall not penetrate through the outer shell, moisture barrier, and thermal barrier to contact the wearer's body when trousers is worn with closures fastened, unless the hardware is located on the waistband or hardware is completely covered by external closure flaps.

Protective trouser trim shall include a circumferential band around each leg between the hem and knee.

Protective trouser trim shall have not less than 500 sq cm of fluorescent area.

Protective trouser trim shall include not less than 260 sq cm of fluorescent area visible from the front and 260 sq cm of fluorescent area visible from the rear when the garment is properly close and is laid on a flat inspection surface.