MSA The Safety Company

BRISTOL

A GUIDE TO EN 469:2020

Performance requirements for
protective clothing for firefighting

WHEN YOU GO IN, WE GO IN WITH YOU.

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1. Introduction

This document has been written to give some explanation and guidance for the recently revised EN 469:2020 Protective clothing for firefighters – Performance requirements for protective clothing for firefighting.

It has been produced for the benefit of users, organisations (Fire and Rescue Services), PPE procurement managers and individuals who purchase or use personal protective equipment covered by the standard, to help them better understand any implications of the revision.

This revised standard is the result of work by Working Group TC162/WG2, who have been responsible for drafting it under EU CEN rules for the revision of standards. This group is made up of interested parties, such as notified bodies, end users and manufacturers. Bristol Uniforms Ltd has been a member of this committee since 1994.

It is a requirement within the revision, that this European standard must be given the status of a national standard, by each country in the European Union (EU) and European Free Trade Association (EFTA), by the end of January 2021. The reference for the standard will include a national identity, as examples below:

Country	Standards Body	Standards Approved Reference
France	AFNOR	NF(Norme Française)
Germany	DIN	DIN (Deutsche Institute für Normung)
Spain	AENOR	UNE (Una Norma Española)

The date of the standard included in its reference may be different depending on the country responsible for the publication, for example BS EN 469:2020, NF EN 469:2021 or DIN EN 469:2020.

The revision of EN 469:2020 was published in the United Kingdom in August 2020 by the British Standards Institution (BSI) and is known as BS EN 469:2020. It now supersedes the 2005 version. This European standard provides the minimum performance requirements for protective clothing for firefighters whilst fighting fires.

This guidance document should only be relied upon for general guidance and represents the understanding of Bristol Uniforms Ltd of the standard at this time. Specific advice should be sought for specific cases and Bristol Uniforms Ltd cannot be held responsible for any action (or decision not to act) made in reliance upon the content of this publication.

2. Transition period

There is no fixed transition period between the 2005 version and the revised 2020 standard. CEN standards are not retrospective. As mentioned, EN 469:2020 must be published in all EU countries no later than 31 January 2021. However, a Notified Body (an accredited institution that issues EU type certificates) may have different policies in relation to the validity of existing certificates. Currently in the UK, certificates are only valid for a maximum of five years.

a) Garments in service and in stock

Both manufacturers and end users of garments will naturally be carrying significant stock of product which complies with the 2005 version of the standard, as well as having a considerable number of garments in service. There is no requirement to withdraw or replace these items.

b) Supply of new garments

End users can continue purchasing new garments compliant to the 2005 standard. As with any purchase of PPE, this will be subject to the employer carrying out a suitable risk assessment as defined in the following UK legislation:

Personal Protective Equipment at Work: Personal Protective Equipment at Work Regulations 1992 Guidance on Regulations 3rd edition 2015, Regulation 6 – Assessment of personal protective equipment.

End users should seek advice from their supplier as to the validity of the relevant EU type examination certificates (formerly known as EC type certificates).

3. Performance

This section covers the major performance changes within the new standard. In summary, these changes are as follows:

a) Performance level is now only determined by contact heat and heat transfer
b) Addition of a contact heat test
c) Update to heat transfer testing
d) Addition of a heat resistance of thread test
e) Removal of the surface wetting test
f) Removal of the ergonomic performance clause
g) Performance level increased for tensile strength structural seam
h) Performance level increased for tear strength

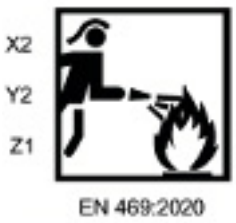
a) Garment performance levels

There are still two performance levels that specify the minimum levels of performance requirements for protective clothing to be worn during firefighting operations:

- **Level 1** is the lower requirement and doesn't provide adequate protection during structural firefighting operations. However, this level may be considered for associated activities, for example rescue work, assistance during disasters, road traffic collisions (RTC) and wildland firefighting. Bristol sells Level 1 garments for all these types of operations. There are associated, specialist standards for these activities such as EN 16689:2017 (rescue), EN ISO 15384:2020 (wildland), ISO 18639-3 (rescue including RTC and urban search and rescue (USAR)).
- **Level 2** is the higher requirement and includes the minimum requirements for clothing to be worn during structural firefighting operations.

In the updated standard, performance levels are now only determined by a garment's thermal performance (contact heat and heat transfer).

Results of the resistance to water penetration and water vapour resistance test no longer determine the level of performance. They have instead been retained as "grades" to give an indication of performance, and are still included on the garment's pictogram, as shown here:



Clause	Test method	Level/grade reference
6.2.1.2	Contact Heat – EN ISO 12127-1:2015	Level 2 = X2
6.2.1.3	Heat Transfer – Flame – EN ISO 9151:2016	Level 1 = X1 Level 2 = X2
6.2.1.4	Heat Transfer – Radiation – EN ISO 6942:2002	Level 1 = X1 Level 2 = X2
6.2.4	Water Penetration – EN ISO 811:2018	Grade 1 = Y1 Grade 2 = Y2
6.3.1	Water Vapour Resistance – EN ISO 11092:2014	Grade 1 = Z1 Grade 2 = Z2

In the updated standard, only X now determines the performance level, so if X is X1 then the whole garment is Level 1, and if it's X2 then it's Level 2. Historically, all numbers on the pictogram had to be 2 for the garment to be Level 2 but this is no longer the case. The example on the previous page shows a Level 2 garment.

The level of personal protection chosen for employees must be the outcome of a risk assessment conducted by the employer (see note on legislation in section 2b on page 4).

b) Contact heat (Clause 6.2.1.2) EN ISO 12127-1:2015

This is a new requirement but only relevant for Level 2 garments. Testing is performed both before and after pre-treatment by cleaning (five cycles).

To evaluate performance, the test method EN ISO 12127-1:2015 is used. This measures the time taken for the temperature to rise by 10°C "inside" the assembly when challenged by a contact temperature of 250°C. The requirement is for this temperature increase to take a minimum of 10 seconds. Each test is carried out on three samples, with the lowest value reported and rounded to the nearest whole second. The lowest recorded value becomes the result for this clause.

c) Heat transfer flame (Clause 6.2.1.3) EN ISO 9151:2016 and radiation (Clause 6.2.1.4) EN ISO 6942:2002

In the updated standard, both heat transfer flame and radiation tests are now performed before and after pre-treatment by cleaning (five cycles), with three tests performed for each. The result of the tests will be the lowest value achieved rounded to the nearest whole second.

The test method used for heat transfer flame has been updated from EN 367 to EN ISO 9151:2016. This does not change the performance requirements at all, but makes the test method more repeatable across all test houses. The test method used for heat transfer radiation has not changed, and still uses EN ISO 6942:2002.

d) Heat resistance of thread (Clause 6.2.1.7) EN ISO 3146:2000

This test has been introduced to ensure that the thread being used, notably on major seams, is flame retardant and suitable for these garments.

Two samples of the thread are exposed to the hotplate test. When exposed to a temperature of 260°C (±5°C) it must not melt.

e) Surface wetting

This test has been removed from the standard. The test method used was very subjective. There was also a direct correlation between this test and the resistance to penetration by liquid chemicals test (Clause 6.2.2) so there was no need for both.

In the new standard, the resistance to penetration by liquid chemicals testing has been simplified. There are now only two chemicals used in testing (previously four), which are H2SO4 and O-xylene (C8H10).

f) Ergonomic performance

This clause has been removed from the standard. It was previously just a place holder as work has been ongoing to define this. It was also linked to an Informative Annex, which was just for information.

The requirement has not been removed, but is now covered by EN ISO 13688:2013. This now has more detail regarding the optimal design of the garments.

g) Tensile strength (Clause 6.2.3.1)

In the updated standard, testing of the main outer fabric is now carried out after pre-treatment by washing. Five samples are tested in both machine and cross direction (EN ISO 13934-1:2013). Theperformance requirement has remained unchanged at ≥450N.

The requirement for the main outer seam has been increased using test method EN ISO 13935-2:2014. The maximum force for seam rupture must be ≥300N.

h) Tear strength (Clause 6.2.3.2)

In the updated standard, testing of the main outer fabric is now carried out after pre-treatment by washing. Five samples are tested in both machine and cross direction. The performance requirement has increased to ≥30N.

4. Design

EN 469:2020 refers to EN ISO 13688:2013 Protective clothing — General requirements for the following requirements:

a) Size designation
b) Design requirements
c) Compatibility and physiological requirements

a) Size designation

EN ISO 13688:2013 continues to refer to ISO 3635 – Size Designation of Clothes – definitions and body measurement procedure for requirements.

It says that: "The design of protective clothing shall facilitate its correct positioning on the user and shall ensure that it remains in place for the foreseeable period of use, taking into account ambient factors, together with the movements and postures that the wearer could adopt during the course of work or other activity. For this purpose, appropriate means, such as adequate adjustment systems or adequate size ranges shall be provided so as to enable protective clothing to be adapted to the morphology of the user."

Bristol Uniforms has a comprehensive range of sizes, which have four height intervals and seven chest/ waist intervals, giving a total of 28 'standard' sizes for both male and female firefighters. Anthropometric surveys (study of human measurements) over the years have confirmed the suitability of the Bristol Uniforms' PPE size range. This includes the work of Dr Mandy Sowerby on the study of female firefighters in the UK.

Whilst not in strict accordance with all the size intervals specified by EN ISO 13688, Bristol Uniforms' fire garments still comply with the PPE EU Regulations, which is the over-arching requirement.

Note: It is not uncommon for manufacturers to use size ranges that do not conform to EN ISO 13688:2013.

b) Design requirements

There are several new design requirements described in EN 469:2020. The most notable of these are as follows:

Closure system (Clause 4.3.4)
Zips shall be designed to lock when completely closed. This is to avoid accidental opening.

External pockets (Clause 4.3.5)
These will be designed so that all external pocket flaps (excluding radio pockets) can be fastened shut. In addition, the flap must extend at least 10mm beyond each side of the pocket.

c) Compatibility and physiological requirements

Annex E, which covers the practical performance testing of the physiological load of firefighters, has been updated.

It is essential that all elements of PPE are compatible. The overlap requirements ensure continued protection at all times. Conformance is assessed through practical testing rather than a specific overlap requirement.

It is always advisable to carry out compatibility testing with the other items of PPE to ensure all interfaces are correct. Other items of PPE may also influence design features to aid compatibility. Bristol Uniforms has a compatible selection of PPE items, which are available for testing with clothing.

In the UK, there is a British standard, BS 8469:2007, Personal protective equipment for firefighters – Assessment of ergonomic performance and compatibility – Requirements and test methods. Compliance to this standard will be separate from BS EN 469:2020 and will require separate testing at the request of the end user.

5. Sampling and pre-treatment

In the revised standard, the majority of performance testing is carried out on fabric/fabric assemblies that have undergone pre-treatment cleaning cycles (wash/dry or dry cleaning).

Clause 5 of the updated standard states that the number of pre-treatments shall be in line with the manufacturers' recommendation, or failing that, five cleaning cycles. The exceptions to this are clauses 6.2.1.5 (Residual Tear Strength), 6.2.1.7 (Heat Resistance Sewing Thread) and 6.2.6.2 (Area of Visibility Material).

The following clauses now require testing both before and after pre-treatment: clauses 6.2.1.1 (Flame Spread), 6.2.1.2 (Contact Heat), 6.2.1.3 (Heat Transfer Flame) and 6.2.1.4 (Heat Transfer Radiation).

6. Visibility

Visibility (Clause 6.2.6) remains optional as part of the standard. PPE performance is linked to EN ISO 20471:2013 High visibility clothing — Test methods and requirements.

The inclusion of this optional requirement in the procurement process should be the result of a risk assessment based upon the operational user requirement. An assessment of the material requirements, made by a Notified Body, will be based on the smallest size available. All round visibility is required by encircling the arms, legs and torso regions of the garment(s).

Below shows the minimum amount of material required to meet this optional part of the standard:

Retro-reflective (silver part of any tape)	0.13m^2
Fluorescent (e.g. yellow, orange etc)	0.20m^2
Combined performance material	0.20m^2

7. Whole garment testing

Commonly known as manikin testing, whole garment testing (Section 7 and Annex D) remains an optional requirement in BS EN 469:2020.

As there are no guidelines for minimum requirements, the results can only be used to compare garment combinations and designs. The test should not be used to describe or appraise a fire hazard or fire risk under actual fire conditions. A high degree of technical knowledge is required to follow the test method and departing from the method will lead to significant differences in the test results. The results from Section 6 of the standard should be used to inform product selection decisions.

The tests mentioned in Annex D of BS EN 469:2020, refer to the requirements from EN ISO 13506-1:2017. This standard provides details of the amount of energy that goes through the garment. Prediction of burn injury can be reported if testing is carried out in line with ISO 13506-2:2017.

The testing requires three garments to be tested but in consideration of the above, a single test following the test method can be considered as indicative.

Bristol Uniforms is the only UK garment manufacturer to sponsor two manikins, male and female forms at BTTG, a Notified Body in Manchester, UK. Other sponsors include the following UK departments:

Health and Safety Executive, Fire Services Inspectorate, Fire Research Division of the Office of the Deputy Prime Minister, Scottish Office Home Department and the UK Chief Fire Officers Association (CFOA).

The manikins at BTTG are known as:

Male Manikin **RALPH – Research Aim Longer Protection against Heat**

Female Manikin **SOPHIE – System Objective Protection against Heat In Emergencies**

Each manikin is fitted with over 130 heat sensors and can be dressed realistically with clothing, gloves, a fire hood, a helmet and breathing apparatus. The heat sensors are located in all regions except the feet and include sensors in the neck, head and fists, with a higher density of sensors at the PPE interface regions. The printouts of the results show a body map, colour coded with predictions of pain and first, second and third degree burn injury regions.

There are other manikins available in the UK, Europe and internationally that can be used for testing to this clause, including SID (Satra Instrumented Dummy) at Satra, Kettering, UK.

At this stage, repeatability of test results across all manikins is unreliable, so it is recommended that the same test facility is used if comparisons are to be made.

8. Further considerations

Testing to the BS EN 469:2020 standard for compliance is usually carried out only on the protective garments without consideration of undergarments. However, consideration should be taken to the properties of any clothing system next to the skin.

Undergarments have been developed to migrate the sweat from the body. The wearer will remain dryer and therefore reduce the risk of steam burns through radiated heat.

In addition to the above, there is a new international standard ISO 21942:2019 - Station uniform for firefighters. This has two performance levels and specifies garments that will not harm wearers.

In both hot and cold climates, it is essential that the skin is kept as dry as possible. The wearing of protective clothing introduces additional sweat management problems such as sweat rashes, excessive perspiration, clamminess and general discomfort. At all times and in all conditions, wearers need to be able to move sweat away from their skin as fast as possible. In addition, they need a next to skin layer which will dry quickly.

The most efficient way for the wearer to maintain a stable core body temperature in all climates is to adopt a layered system. Structural firefighting clothing provides breathable layered protection to ensure maximum evaporation potential whilst maintaining performance. The next to skin layer, undergarments, have the primary task of moisture management.

There are a number of solutions, for moisture management, available from Bristol Uniforms with a choice of fabrics and finishes.

9. Contact us

For further details, guidance or advice in connection with this document or other general PPE queries, please contact us:

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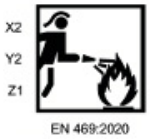
Appendix A

Summary of basic differences in requirements between EN 469:2005 & EN 469:2020

Summary of basic differences in requirements between EN 469:2005 & EN 469:2020

EN 469:2005	EN 469:2020	Comments
4 General Clothing Design	**4 Design**	Links to EN ISO 13688:2013, in particular sizing and design. It expands on a number of the areas identified in the 2005 standard, stipulating the maximum depth of antiwicking and drain mesh fabrics. Details of closure systems and pocket flap design as well.
5 Sampling and Pre-treatment	**5 Sampling and Pre-treatment**	Pre-treatment in accordance with the manufacturer's instructions or if not stipulated five cleaning cycles. The majority of tests in section six are after pre-treatment, with a number performed both before and after pre-treatment. (see section 6 for more details)
6.1 Flame Spread	**6.2.1.1 Flame Spread**	New test method EN ISO 15025:2016 with testing also carried out on seamed samples and the wristlet.
	6.2.1.2 Contact Heat	This is a new test using test method EN ISO 12127-1:2015. The minimum requirement is a value of at least 10 seconds.
6.2 Heat Transfer (Flame)	**6.2.1.3 Heat Transfer (Flame)**	Two Levels using new test method EN ISO 9151:2016, although the required performance levels are unchanged. Level 1 is the lower level (symbol X1) Level 2 is the upper level (symbol X2) The level of protection chosen is based on the end users' risk assessment. (see section 3 for more details)
6.3 Heat Transfer (Radiation)	**6.2.1.4 Heat Transfer (Radiation)**	Test method EN ISO 6942:2002. The requirements are not changed. Level 1 is the lower level (symbol X1) Level 2 is the upper level (symbol X2) The level of protection chosen is based on the end users' risk assessment. (see section 3 for more details)
6.4 Residual Strength	**6.2.1.5 Residual Strength**	New test method EN ISO 13934-1:2013, after pre-treatment and EN ISO 6942:2002 (coated materials), with the same requirement of ≥ 450N.
6.5 Heat Resistance	**6.2.1.6 Heat Resistance**	Updated test method ISO 17493:2016 performance requirement is unchanged.
	6.2.1.7 Heat Resistance Thread	New requirement, test method EN ISO 3146:2000, ensuring heat resistance of thread used in the major seams.
6.10 Resistance to Penetration by Liquid Chemicals	**6.2.2 Resistance to Penetration by Liquid Chemicals**	Testing using the test method EN ISO 6530:2005 after pre-treatment. Now only two chemicals H_2SO_4 and O-xylene, with the repellency rates remaining at > 80% run off and no penetration to the innermost surface of the assembly.
6.6 Tensile Strength (Outer & Seams)	**6.2.3.1 Tensile Strength (Outer & Seams)**	After pre-treatment, new test method, EN ISO 13934-1:2013 for outer cloth with an unchanged requirement of ≥ 450N. For the main seams of the outer material using updated test method EN ISO 13935-2:2014 the required breaking load is increased to ≥ 300N.

Summary of basic differences in requirements between EN 469:2005 & EN 469:2020

EN 469:2005	EN 469:2020	Comments
6.7 Tear Strength	**6.2.3.2 Tear Strength**	The test method is unchanged EN ISO 13937-2:2000, but with an increased requirement of ≥ 30N.
6.8 Surface Wetting		This has been removed from the standard as the resistance to liquid chemicals (6.2.2) gives a similar result.
6.11 Resistance to water Penetration	**6.2.4 Resistance to water Penetration**	Testing to EN ISO 811:2018 now done after pre-treatment and includes a seamed sample. The requirement has been revised to accommodate two grades: Grade 1 is the lower level (symbol Y1) Grade 2 is the upper level. (symbol Y2) The level of protection chosen is based on the end users' risk assessment. (see section 3 for more details)
6.9 Dimensional Change	**6.2.5 Dimensional Change**	This clause refers to EN ISO 13688:2013 with testing carried out after pre-treatment with a requirement of ±3% for each single layer.
6.13 Ergonomic performance		This has been removed but is covered by EN ISO 13688:2013.
6.14 Visibility	**6.2.6 Visibility**	Reflective tape remains optional but when required shall conform to the following requirements. Performance requirements are based on EN ISO 20471:2013: Minimum area for retroreflective = ≥0.13m^2 Minimum area for fluorescent or combined performance = ≥0.2m^2 (see section 6 for more details)
6.12 Water Vapour Resistance	**6.3.1 Water Vapour Resistance**	Testing to new test method EN ISO 11092:2014 after pre-treatment. The requirement gives two grades: Grade 1 is the lower level (symbol Z1) Grade 2 is the upper level. (symbol Z2) The level of protection chosen is based on the end users' risk assessment. (see section 3 for more details)
6.15 Optional test-whole garment testing	**7 Optional test-whole garment testing**	Manikin test to EN ISO 13506-1:2017. The test method as Annex D. Three samples are required for testing. (see section 7 for more details)
8 Marking	**8 Marking**	Level/Grade of protection must be shown adjacent to the pictogram.  (see section 3 for more details)

Summary of basic differences in requirements between EN 469:2005 & EN 469:2020

EN 469:2005	EN 469:2020	Comments
8 Information	**8 Information**	Information to be written at least in the official language of destination and in accordance with EN ISO 13688:2013 section 7.
	Annex A (Normative)	Performance Rating including uncertainty of measurement.
	Annex B (Informative)	Contamination during use including guidance on cleaning.
	Annex C (Informative)	Extract from CEN TR/14560:2018 – Selection, Use, Care and Maintenance of Firefighter PPE.
	Annex D (Informative)	Whole garment testing.
	Annex E (Informative)	Physiological/heat stress hazards.
	Annex F (Informative)	Significant changes from EN 469:2005.
	Annex G (Informative)	Rationale for the changes made to EN 469.
	Annex ZA	Information annex on the relationship between the EN 469 standard and the essential requirements of the EU Regulations (EU) 2016/45.

MSA The Safety Company

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ABOUT
MSA – THE SAFETY COMPANY

Established in 1914, MSA Safety Incorporated is the global leader in the development, manufacture and supply of safety products that protect people and facility infrastructures. Many MSA products integrate a combination of electronics, mechanical systems and advanced materials to protect users against hazardous or life-threatening situations. The company's comprehensive product line is used by workers around the world in a broad range of markets, including the oil, gas and petrochemical industry, the fire service, the construction industry, mining and the military. MSA's core products include self-contained breathing apparatus, fixed gas and flame detection systems, portable gas detection instruments, industrial head protection products, fire and rescue helmets, and fall protection devices.

Accompanying you in firefighting, emergency response and search and rescue, our Bristol line is one of the world's leading emergency services protective clothing brands, with history dating back to 1801.

WHEN YOU GO IN, WE GO IN WITH YOU.

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Note: This Bulletin contains only a general description of the products shown. While product uses and performance capabilities are generally described, the products shall not, under any circumstances, be used by untrained or unqualified individuals. The products shall not be used until the product instructions/user manual, which contains detailed information concerning the proper use and care of the products, including any warnings or cautions, have been thoroughly read and understood. Specifications are subject to change without prior notice.

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