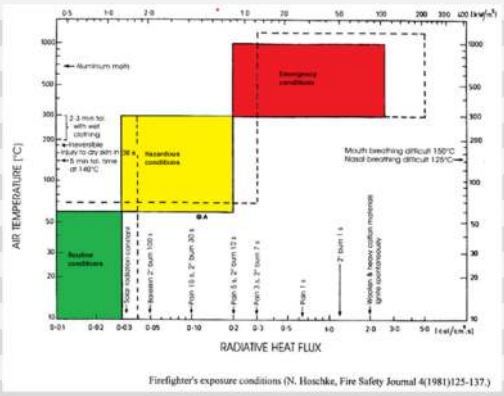
GRISU - under this name of the comic`s little dragon which liked to be a fireman - ALWIT manufactures and distributes Personal Protective Equipment (PPE) for firefighters, independent of outer shell material, color, and location, size or kind of pockets, retroreflective or/ and fluorescent elements.

Developing **GRISU** the Basic Health and Safety Requirements of Annex II of Regulation (EU) 2016-425 (before: Directive 89/686) have been taken into consideration. That concerns especially the choice of materials as well as the design of the garments.
All these types of **GRISU** are designed according the basic and additional requirements of EN 469.
Based on the Basic Health and Safety Requirements (BHSR) of the European Regulation, the manufacturer has to explain how long the user may be exposed to the incident heat transmitted by the PPE.
On the one hand this factor is very much depending on the physical constitution of the user (fitness), on the other hand, the amount of the heat transmission during firefighting is quite different, and cannot be determined. It will even normally change during the application (several times).
Therefore, only some values are returned here which arise from the diagramme of Hoschke „ firefighters` exposure conditions”.

Exposition	Duration	Temperature	Heat flux density
a) normal	8 h	40°C	1 kW/m²
b) dangerous	5 min	250°C	1,75 kW/m²
c) emergency	10 s	800°C	40 kW/m²

In modern fire protective clothing and also in this PPE used materials own a high heat capacity. This means that they take up heat for a longer period, store and then suddenly, without warning pass on to the body. Therefore, it is urgently to be recommended to retreat from the danger zone with the smallest sign of a heat transfer.



Firefighter's exposure conditions (N. Hoschke, Fire Safety Journal 4(1981)125-137.)

GRISU may be manufactured with detachable thermal lining or with fixed sewn-in lining.
In case of detachable lining each layer is marked with a label, warning that the requirements of EN 469 are only met, if all layers were used together.
In this case also a separable connection between the layers inside at the bottom seam of jacket prevents the chimney effect that means entry of flames.

GRISU is intended to protect firefighters' body excluding head, hands, and feet, from the effects of heat and flame at firefighting.
That means that additional personal protective equipment is needed to protect the head, hands, and feet, and in many firefighting situations breathing apparatus must be worn.

Even the built-in moisture barrier that allows the passage of water vapor, and/or the FC-impregnated outer shell material may offer a certain protection against chemicals, **GRISU** shall not be used as chemical protective suit.

GRISU does not cover special clothing for use in high risk situations with a high amount of radiant heat, where aluminized PPE would be needed (“proximity suits”) as for fighting fire in oil refineries, fuel depots, or clothing for use in long term firefighting operations in high ambient temperatures, e.g. forest firefighting.
It also does not cover protection against other hazards, e.g. chemical, biological, radiation (radioactive) and electrical hazards.
These hazards may be dealt with other ALWIT protective garments according to other standards as far as part of our delivery program.

GRISU is made of several material layers (material assembly) which moreover are to be washed or cleaned different because its various accessoires.
In order to get a simple and standardized way of care the material developments have been harmonized with the manufacturers of raw materials so that the protective clothing may be washed at one temperature only or be dry cleaned, too.
The corresponding **care labels** can be found in the garments and on the packing.

In order to avoid storage of foreign substances, e.g. cotton fibers, protective garments **should be washed separately** from other garments. So the inherently flame retardant properties of the garment will be saved, and contamination will not be saved, and contamination will not be carried off into the private sphere.

Keep garments clean!

Residues of oil, fat or dust might reduce the protective properties. Regular and in time care would be expedient.

Before washing or cleaning all touch and close fasteners should be **covered by a pendant** in order to avoid a damage on the surface of the fabrics and retroreflective and/or fluorescent elements by the hook part of the fasteners, and to avoid the storage of fibers on the closure system, too.
Clothing has not to be turned to the left (inner) side.

Alternative the protective garments may be washed or cleaned with fasteners closed.
But then the **cleaning effect** on the inside of the garment would be **limited** because the waterproof membrane.

Do **not stitch sharp objects** as needles or cramps through the garment because the waterproof membrane might be damaged.

If possible, **hardware** (e.g. hooks) and rear shields are to **remove** or to put into the pockets before washing, and pockets are to empty from other objects.

Avoid scrubbing as a form of cleaning. Extreme dirty areas might be slightly pre-brushed.

Pay also attention to the fact that abrasion by use or care may reduce the **warning effect** of retroreflective and/or fluorescent trims.

Please check therefore the remaining warning effect in time and send the garment back to us for touching up.

ALWIT sews protective garments by using threads of aramid fibers; therefore **repairing works** should be done with material supplied by us or by ourselves.

Printings on retro-reflective and/or fluorescent materials are subject of higher abrasion and should not be washed or cleaned. We recommend therefore to select such printings on detachable shields.

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Attention should be paid to the detailed washing and care instructions further down on this information which has been developed together by the manufacturers of most important components of the clothing as outer shell and lining material, breathable moisture barrier and elements for high visibility.

Washing procedure

Washing-/tumbling machine up to 20 kg

domestic washing might be generally possible in front loading machines up to 5 kg, but it is not recommended because carrying the contamination into the private sphere, and because there is no possibility to re-impregnate the clothing as needed.

Filling ratio of washing machine

2/3 capacity of cylinder

Washing programme

Coloured laundry at temperatures up to 60°C with relation of washing bath of 1:5

Detergent

Washing protective clothing the bath should have a ph-value <10

Generally commercial detergents for colored laundry should be taken. Fully washing detergents contain brightening agents, and are therefore not appropriate.

Do not use softeners.

Do not use bleaching agents or products that contain such decolorizer.

Rinsing

After washing protective clothing shall be rinsed carefully in order to remove all residual alkaline and probably inflammable detergents.

2-3 rinsing cycles are recommended.

Note: Programs for colored laundry have usually 3 rinsing cycles which are sufficient to remove all residues from the clothing.

Re-impregnation

Water, oil and dirt repellent re-impregnation might be useful for better care, and has a positive influence on durability and efficiency of protection of the clothing.
Impregnation by fluorcarbonate during the last rinsing bath and consecutive heat treatment in the tumbler is recommended.

Impregnation by fluorcarbonate will loose its properties after about 10 washing cycles; in order to avoid uncontrolled lost of repellent properties and probably irresponsible administration and organisation **re-impregnation after each washing cycle** is recommended.

How to find out that the dirt and oil repellent impregnation has to be renewed?

Keep the outer shell material of clothing under water; wether the water is running off the impregnation is still working.
Wether the water penetrates the outer shell material clothing should be re-impregnated as above mentioned.

Drying

After rinsing respectively re-impregnation cycle the bath has to be let off and the clothing shall be tumbled in intervals.
Hereafter the clothing shall be dried at 80°C (temperature at cylinder exit) in the tumbler until the residual humidity becomes -2%.

Note: Residual humidity of -2% means slightly overdrying.
Under these conditions the film of fluorcarbonate gives an optimal effect.

Ironing

Protective clothing **GRISU** may be ironed at a middle temperature setting (2 points) without vapour.
In order to protect retroreflective and/or fluorescent materials trims should be covered by a cloth.

Dry cleaning

Dry cleaning is recommended for extremely dirty clothing, e.g. contaminated by oil or fat but also by human or animal body fluids, to avoid carrying dangerous substances into the private sphere.

Dry cleaning shall be carried out according to the care label by usual 2-bath system using a booster and with reduced mechanics. Commercial dry cleaning with perchlorethylene is recommended. Touch and close fasteners are to be covered also while dry cleaned.

This kind of dry cleaning may only be carried out by specialists.

Before protective clothing will be re-used it must be sure that the clothing is free of residual solvents.
Therefore the clothing should ventilate after dry cleaning at least for one day.

Take care that there are no cleaning labels clamped on the clothing because they might damage the water barrier.

Absolutely pay attention to the instructions of the care label which is sewn into the inner part of clothing.

Storage

To avoid fading of colors protective clothing should not be stored under bright sunlight or other UV-radiating sources of light. Heat or flame protective properties will not be influenced by UV-radiation.

Protective clothing shall be stored dry and dust free.

During long-time use protective clothing shall be checked regularly by maximum own responsibility if all layers are intact and functional; otherwise the protective clothing shall be replaced.

Disposal

Used and separated protective clothing may be recycled if it has been cleaned before orderly.

Otherwise - depending on the contamination - it can be disposed of with household waste.

If there are any further questions regarding use or maintenance of our protective clothing „GRISU“ please do not hesitate to contact confidently our team.

Complementary information about trousers

The information given before is basically applicable also for trousers and bib coveralls of the „GRISU“ – family. They are valid without any restriction when trousers or bib coveralls are made of same material assembly as the jacket.

If, after a risk assessment, for reasons of better wearing comfort, lining is not provided in certain areas or if one or more lining layers are missing in total, the requirements of EN 469 are not fully met in these areas.

According to EN 469, such trousers only meet performance level 1 (see also Info 33-00) or even only the requirements of EN ISO 11612. Although they can be used as station uniforms, they cannot be used for firefighting.
However it should be possible to meet the requirements of level 2 of EN 469 with trousers which have partially level 1 areas if these areas are covered by a level 2 jacket of sufficient length.

Because jackets of level 2 is always designed with a fixed or detachable thermal lining, the intermediate moisture barrier is always protected by the thermal liner against abrasion.

Not so with trousers of level 1 of EN 469 which might have the moisture barrier as innermost lining.
In this case the moisture barrier is subject to higher mechanical stress during wear and washing/cleaning and needs better abrasion strength. Therefore these models are lined with a moisture barrier where the membrane is protected by a strong rear side, preferably from Nomex® Comfort, instead of non-woven, e.g. E 89 (Sontara®).

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Washing recommendations for multi-layer PPE containing moisture barrier

(conclusion)

Machine: **Washing-/tumbling**
Filling ratio: **2/3 capacity of cylinder**

Step	Level	Time [min]	Temperature [°C]	Turns	Quantity [ml/kg]	Product
1. Run	medium	8	40		25,0	DERVAL RENT
2. Run	medium	10	60		12,5	DERVAL RENT
Intermediate tumbling	slow	1		500 U/min		
1. Rinsing	high	3	kalt			
2. Rinsing	high	3	kalt			
Finishing bath	low 1 : 3	10	40		60 resp. 20 ml/l	HYDROB FC
Interval tumbling	2x	1		500 U/min		
Interval tumbling	1x	2		1000 U/min		

Concerning the criteria for the selection, use, care, maintenance and storage the information given in info 0-150 (Nomex®) are valid basically. By the composition of the fire protective clothing from different materials and design so many types are possible. Below you might find our wide range of products. Theoretically each layer of material can be combined with each other, e.g. A1 + B3 + C2. Practically not all combinations are already approved and certificated.

Available material assemblies

	Trade name	Description	Material number	Test report
A. Outershell				
1	Nomex® Outershell Tough	75% Nomex® / 23% Kevlar® / 2% P140, 195 g/m²	930.6 gold / 930.8 blue	tested as assembly only, see below
2	Nomex® Outershell Tough	75% Nomex® / 23% Kevlar® / 2% P140, 215 g/m²	931.5	tested as assembly only, see below
3	Nomex® Comfort	93% Nomex® / 5% Kevlar® / 2% P140, 265 g/m²	805.Z*	tested as assembly only, see below
4	PBI® Matrix	58% Kevlar® / 40% PBI / 2% P140, 205 g/m²	924.2	tested as assembly only, see below
5	Nomex® NXT	93% Nomex® / 5% Kevlar® / 2% P140, 195 g/m²	933.8	Material assembly only, see below
B. Moisture barrier				
1	Fireblocker PU	PU Membran / 50% Basofil® / 25% Nomex® / 25% Kevlar®, 90 g/m²	818.8	tested as assembly only, see below
2	Flameliner	PU Membran / Nomex® III Ripstop, 155 g/m²	818.2	tested as assembly only, see below
3	3D Fireblocker	DUO Membran PTFE / 3D Aramid Vlies, 140 g/m²	817.6	Material assembly only, see below
C. Therma- /inner lining				
1	Airliner	Nomex® Comfort, Ripstop, darkblue, 200 g/m²	822.8	tested as assembly only, see below
2	Thermoliner	Meta-Aramid fleece, 110 g/m², quilted with Nomex®/ FR Viscose, 120 g/m²	823.5	tested as assembly only, see below
3	Thermoliner	Meta-Aramid fleece, 150 g/m²,quilted with Nomex®/ FR Viscose, 130 g/m²	823.6	tested as assembly only, see below
4	Comfort Liner	50 / 50% meta-Aramid / FR Viscose, hydrophilic by construction	823.8	Material assembly only, see below
D. Retro-reflective / fluorescent tapes				
1	3M Trim 9687	yellow / silver / yellow, retro-reflective + fluorescent, 5 + 7,6 cm wide	546.6 / 7	EN 469, EN 471, EN 533
2	3M 8940	silver, retro-reflective, 5 cm wide	506.5	EN 469, EN 471, EN 533
3	3M 8987	yellow, fluorescent, 5 cm wide	548.1	EN 469, EN 471, EN 533
4	3M 8986	red, fluorescent, 5 cm wide	547.2	EN 469, EN 471, EN 533
5	Reflexite FTP 2100	lime yellow, fluorescent + retro-reflective, 5 + 7,5 cm wide	502.6 / 7	EN 469, EN 14116, EN 20471

E. Approved and certificated garments

(other types will be approved and certificated upon order of at least 100 units)

	P/N	Material assembly	Test house / NB
1a	33-2089.61/930.8	A1 + B1 + C1 + D1	BGIA Alte Heerstraße 111, D-53757 St. Augustin
1b	36-0089.61/930.8	A1 + B1 + C1 + D1	Certificate 0901023
2a	33-6109.61/930.8	A1 + B1 + C1 + D1	BGIA Alte Heerstraße 111, D-53757 St. Augustin
2b	36-5159.61/930.8	A1 + B1 + C1 + D1	Certificate 0901023
3a	33-XXXX.32/805.Z*	A3 + C2 + D (different)	BGIA Alte Heerstraße 111, D-53757 St. Augustin
3b	36-XXXX.32/805.Z*	A3 + C2 + D (different)	Certificate 98 1141
3c	39-XXXX.32/805.Z*	A3 + C2 + D (different)	
4a	33-XXXX.67/930.8	A1 + B1 + C2 + D (different)	BIA Alte Heerstraße 111, D-53757 St. Augustin
4b	36-XXXX.67/930.8	A1 + B1 + C2 + D (different)	TR IFA 97 06724/Certificate FIH 97.0.7214
5a	33-8503.12/931.5	A2 + C3 + D 5	IFA Alte Heerstraße 111, D-53757 St. Augustin
5b	36-8503.12/931.5	A2 + C3 + D 5	Certificate IFA 1101047
6a	**33-2109.70/933.8**	**A5 + B3 + C4 + D1**	**AITEX**
6b	**36-0109.70/933.8**	**A5 + B3 + C4 + D1**	**Test Report 216CO0513**

Comparison of different material assemblies concerning the requirements of EN 469

	Material assembly					
Outershell	Nomex® Outershell	Nomex® Comfort	Nomex® Outershell	Nomex® Outershell	PBI® Matrix	**Nomex® NXT**
	215 g/m² (931.5)	265 g/m² (805.Z)	195 g/m² (930.6 / 8)	195 g/m² (930.6 / 8)	200 g/m² (924.2)	**195 g/m² (933.8)**
Moisture barrier	w/o moisture barrier	w/o moisture barrier	Fireblocker PUR	Fireblocker PUR	Fireblocker PUR	**3D Fireblocker PTFE**
			90 g/m² (818.8)	90 g/m² (818.8)	90 g/m² (818.8)	**140 g/m² (817.6)**
Thermal- / inner lining	meta-Aramid fleece /	meta-Aramid fleece /	Nomex® Comfort,	meta-Aramid fleece /	Nomex® Comfort,	**50% meta-Aramid /**
	Nomex®/FR Viscose	Nomex®/FR Viscose	AIRLINER	Nomex®/FR Viscose	AIRLINER	**50% FR Viscose**
	280 g/m² (823.6)	230 g/m² (823.5)	200 g/m² (822.8)	230 g/m² (823.5)	200 g/m² (822.8)	**Comfort Liner**
						130 g/m² (823.8)
Lining code	12	32	61	67	61	**70**
Material assembly, weight in g/m²	495	495	485	515	490	**465**
Weight of a jacket, 80 cm, w/o tapes	1.346	1.346	1.319	1.400	1.333	**1.264**
Requirement EN 469	931.5 / 823.6	805.Z / 823.5	930.Z / 818.8 / 822.8	930.Z / 818.8 / 823.5	924.2 / 818.8 / 822.8	**933.8 / 817.6 / 823.8**
Flame spread - EN ISO 15025 A	A1	A1	A1	A1	A1	**A1**
Heat resistance - EN ISO 17493	passed	passed	passed	passed	passed	**passed**
Heat transfer – flame						
EN 367 (80 kW/m²)						
Level 2: HTI_{24} / HTI_{24}-HTI_{12}	13 / 4	14 / 5	19 / 5	27 / 10	17 / 4	**16 / 5**
Heat transfer - radiant						
EN ISO 6942 (40 kW/m²)						
Level 2: $RHTI_{24}$ / $RHTI_{24}$-$RHTI_{12}$	19 / 5	22 / 10	19 / 4	23 / 6	19 / 5	**18 / 5**
Residual strength after heat expos.						
ISO 13934 / EN ISO 6942 (10 kW/m²)						
Tensile strength ≥ 450 N warp/weft	1175 / 1193	1252 / 1131	1243 / 1193	1243 / 1193	1390 / 1510	**1362 /1036**
Tensile strength – ISO 13934						
≥ 450 N in warp / weft	1215 / 1210	1229 / 946	1215 / 1210	1215 / 1210	2400 / 2200	**1200 /1300**
Tear strength – ISO 4074						
≥ 25 N warp / weft	40 / 38	92 / 107	40 / 38	40 / 38	204 / 189	**370 / 490**
Seam strength – ISO 13935						
≥ 225 N	350	350	353	353	460	**368**
Resistance to water - EN 20811						
Level 1: < 20 kPa	1,6	<20				
Level 2: ≥ 20 kPa			3x >20	3x >20	3x >20	**>20**
Surface wetting – EN 24920						
Spray rate ≥4	4-5	5	4	4	5	**5**
Dimensional change – ISO 5077						
≤ 3% warp / weft	-0,6 / -1,8	-1,5 / -1,0	-1,5 / -2,0	-1,5 / -2,0	-2,0 / -1,5	**-1,5 / -0**
Resistance to liquid chem.– EN 368						
Run off > 80%	passed	passed	passed	passed	passed	**passed**
Penetration	no	no	no	no	no	**no**
Water vapour resistance – EN 31092						
Level 1: > 30 m^2Pa/W						
Level 2: ≤ 30 m^2Pa/W	15,05	15,05	19,24	< 30	19,24	**14,96**
Visibility – EN ISO 20471						
Retro-reflective ≥ 0,13 m²	Depending on model and design; passed with all new models					
Fluorescent ≥ 0,20 m²	Depending on model and design; passed with all new models					
Optional whole garment test						
ISO 13506						
Test is executed on an instrumented	not yet tested	not yet tested			not yet tested	**not yet tested**
manikin with 84 kW/m² for 8 s,						
imitating a flash over situation						
Burn injuries of 2. degree			6%	1%		
Burn injuries of 3. degree			1%	0%		
Total burn injuries			7%	1%		
Price comparison of a						
jacket, mod. 33-2089	86 %	86 %	100	95 %	132 %	**104 %**

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