

HYDROBLAST > 

# SAFETY AND TECHNICAL INFO



# SAFETY FIRST

Is it really necessary to always use PPE (Personal Protective Equipment) when working with high pressure cleaning or waterjetting? Before you answer, read this.

Your eyes are at risk of damage already at a pressure of 7 bar/100 psi and above. Skin penetration may occur from 80 bar/1 160 psi. High pressure cleaning uses approximately 200 bar/2 900 psi. In waterjetting the pressure is 1 200 bar/17 400 psi or more, that's enough to cut through concrete! What it could do to the human body isn't hard to imagine. Unfortunately we have seen these effects. That is why our motto is "Saving Lives".

Waterjetting can be dangerous even if you do everything right. Accidents happen when you least expect them to. Hoses burst

and couplings break. Even the most experienced worker may slip. That's why you should never allow exemptions from wearing PPE even for jobs that "will only take a few minutes". If you are within an area of about 25 meters radius from high water pressure activities – regardless of it being performed by a colleague, a robot, or an automated solution – we highly recommend that you use PPE.

Employers have obligations concerning the provision and use of PPE at work. By using our products, you will contribute to a safer workplace where the workers safety and welfare is highly valued. Make sure that your employees get to go home to their loved ones, every day – and are fit for work again the next day.

**CE** All of our personal protective equipment is CE certified. TST Sweden are also certified in accordance with ISO 9001:2015 and ISO 14001:2015 – important tools for ensuring the quality of our products and our work to lay the foundation for positive environmental development.



Eyes risk damage  
at 7 bar / 100 psi

Skin penetration  
may occur from  
80 bar/1 160 psi

TST Swedens PPE  
withstands up to  
3 000 bar/43 500 psi

# TEST RESULTS

## TEST RESULTS - PROTECTION LEVELS

**How to read the test results:** There is no international standard for the testing of protection levels. Therefore the testing can differ significantly between companies. For this reason it is crucial to be aware of the differences and how and what to properly compare. A protection level of eg. 3 000 bar can mean different things, depending on the pressure, flow, nozzle, distance or speed used while testing. To verify the protective

qualities we have chosen the most common working conditions when performing our tests of notified body. Most nozzles perform at their best between 50 and 100 mm, therefore we have chosen the distance of 75 mm. Rotating tests have been performed with two nozzles (adding more nozzles result in a lower overall impact). On this and the next spread, you can read how our products are tested.

## GUIDE - PROTECTION LEVELS PPE



## PROTECTIVE CLOTHING

Product category	Pressure		Flow		Nozzle				RPM Revolutions per minute	Distance		Linear speed		Result
	Bar	Psi	Litre/minute	Gallon/minute	Type	Quantity	Diameter mm	Diameter in		mm	in	m/s	in/sec	
EliteOperator	2 000	30 000	17.9	4.7	Single	1	0.8	0.031	-	75	3	0.5	20	No penetration
EliteOperator	3 000	43 500	19.5	5.2	Rotor	2	0.6	0.024	3 000	75	3	0.5	20	No penetration
10/28	1 000	15 000	19.8	5.2	Single	1	1.0	0.039	-	75	3	0.5	20	No penetration
10/28	2 800	40 000	18.8	5.0	Rotor	2	0.6	0.024	3 000	75	3	0.5	20	No penetration
ProOperator	200	3 000	10.7	2.8	Single	1	1.1	0.04	-	75	3	0.5	20	No penetration
ProOperator	500	7 500	16.9	4.5	Rotor	1	1.1	0.04	N/A	75	3	0.5	20	No penetration
ProOperator	500	7 500	16.9	4.5	Flat	1	1.1	0.04	-	75	3	0.5	20	No penetration

Note! Different values, eg. pressure, flow, nozzle, distance or speed, can give significantly different results!

## OVERVIEW – PROTECTION LEVELS CLOTHING

Product category	Single		Rotor		Flat	
	Bar	Psi	Bar	Psi	Bar	Psi
EliteOperator	2 000	30 000	3 000	43 500	-	-
10/28	1 000	15 000	2 800	40 000	-	-
ProOperator	200	3 000	500	7 500	500	7 500

## HEAD PROTECTION 3000 BAR

Pressure		Flow		Nozzle				RPM	Distance		Linear speed		Result
Bar	Psi	Litre/minute	Gallon/minute	Type	Quantity	Diameter mm	Diameter in		mm	in	m/s	in/sec	
2 000	30 000	17.9	4.7	Single	1	0.8	0.031	-	75	3	0.5	20	No penetration
3 000	43 500	19.5	5.2	Rotor	2	0.6	0.024	3 000	75	3	0.5	20	No penetration

## BOOTS 3000 BAR

Pressure		Flow		Nozzle				Distance		Linear speed		Thrust		Result
Bar	Psi	Litre/minute	Gallon/minute	Type	Quantity	Diameter mm	Diameter in	mm	in	m/s	in/sec	N	lbs	
1 700	25 000	20.0	5.3	Single	1	1.0	0.039	75	3	0.2	7.9	250	56	No penetration
2 500	36 000	19.0	5.0	Monro-Jet	1	0.8	0.031	75	3	0.2	7.9	227	51	No penetration
3 000	43 500	19.0	5.0	Rotor	3	0.5	0.020	75	3	0.2	7.9	243	55	No penetration
3 000	43 500	16.2	4.3	Single	1	0.8	0.031	75	3	0.2	7.9	207	47	No penetration

## PROOPERATOR – HYDRAULIC FLUID

ProOperator is tested for high pressure hydraulic fluid according to the table below. The smallest Sapphire nozzle, only 0.15 mm, has been used to simulate a so called pin burst. Please note that *Gloves 500 bar* and *ProOperator Boots* are not tested for hydraulic fluid. **Note! Different values, eg. pressure, flow, burst size, distance or speed, can give significantly different results!**

Pressure		Nozzle				Distance		Linear speed		Break through time
Bar	Psi	Type	Quantity	Diameter mm	Diameter in	mm	in	m/s	in/sec	
250	3 750	Single	1	0.15	0.006	5	0.2	0	0	> 60 s
350	5 100	Single	1	0.15	0.006	5	0.2	0	0	35 s
500	7 500	Single	1	0.15	0.006	5	0.2	0	0	4 s

## HOSE PROTECTION

Product	Diameter		Burst test			Pinhole leak test	
	mm	inch	Bar	Psi	Result	Tested	Result
Hose Protection 3000	36, 47, 59	1.42, 1.85, 2.32	3 000	43 500	No penetration	Yes	No penetration
Hose Connection Cover	61	2.40	3 000	43 500	No penetration	No	-
Hose Protection ProOperator	41	1.61	1 800	26 100	No penetration	No	-
Whip Stop	-	-	-	-	30 kN	-	-

## WORKPLACE SAFETY SOLUTIONS

### HIGH PRESSURE WATER JET TEST

Test is relevant for	Pressure		Flow		Nozzle	Newton	Distance	Result
	Bar	Psi	Litre/minute	Gallon/minute				
Curtain	1 100	16 000	100	26.4	Single	740	2.3 m / 7.5 ft	No penetration
Curtain	3 000	43 500	43	11.4	Single	550	1.5 m / 5 ft	No penetration
Funnel	1 400	20 300	40	10.5	Tube nozzle	350	75 mm / 3 in.	No penetration

### PROJECTILE TEST

Projectile	Linear speed		Number of textile layers	Result	ISO Standard
	m/s	ft/sec			
Steel bullet, 6 mm	120	393.7	1	No penetration	EN ISO 168
Stone shot, 360 g	13	42.7	1	No penetration	EN ISO 1794-1

## TECHNICAL DESCRIPTION

### ELITEOPERATOR

**Outer material:** DWR (Durable Water Repellent) treated Techsteel™. **Inner material:** Polyester mesh. **Protective material:** Special fabric containing Dyneema® fiber. Seams are taped. **CE-marking:** Approved according to the Regulation (EU) 2016/425.

### HEAD PROTECTION 3000 BAR

Helmet is made of fiberglass reinforced polyamide. Temperature range -30° to +150°. Recommended life span 3–5 years. **CE-marking:** Approved according to Industrial safety helmets: EN397:2012. Eye protection: EN166:2001. Hearing Protection: EN 352-3:2002 and Regulation (EU) 2016/425.

### 10/28

**Outer material:** DWR (Durable Water Repellent) treated polyamide. **Inner material:** Polyester mesh. **Protective material:** Special fabric containing Dyneema® fiber. Seams are taped. **CE-marking:** Approved according to the Regulation (EU) 2016/425.

### PROOPERATOR

**Outer material:** DWR (Durable Water Repellent) treated polyamide. **Inner material:** Polyester mesh. **Protective material:** Special fabric containing Dyneema® fiber. Seams are taped. **CE-marking:** Approved according to the directive Regulation (EU) 2016/425.

### WORKPLACE SAFETY SOLUTIONS

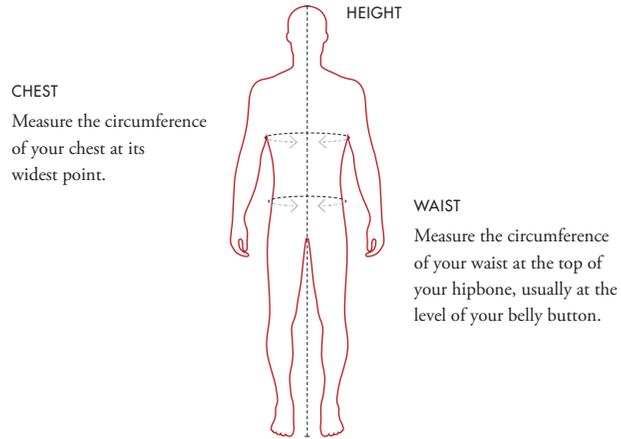
**Material:** DWR (Durable Water Repellent) treated Techsteel™.

## MARTINDALE ABRASION TEST

The Martindale abrasion test simulates natural wear of a textile, in which the textile sample is rubbed against a standard abrasive surface with a specified force. Domestic cotton fabrics often have a rating of 20 000 rubs and polyester fabrics have 30 000.

The Techsteel™ glossy fabric in EliteOperator and Workplace Safety Solutions has over 500 000. The outer fabric in 10/28 and ProOperator has a rating of 300 000. The method for Martindale test is EN ISO 12947-1:1998.

# SIZING TABLES



SINGLE SIZES

Sizes (Mens)	Height		Chest		Waist	
	cm	ft and inch	cm	inch	cm	inch
<b>XS</b>	168 - 180	5' 6" - 5' 11"	84 - 88	33 - 35	72 - 76	28 - 30
<b>S</b>	168 - 184	5' 6" - 6' 1/2"	92 - 96	36 - 38	80 - 84	31 - 33
<b>M</b>	168 - 184	5' 6" - 6' 1/2"	98 - 104	39 - 41	88 - 92	34 - 37
<b>L</b>	176 - 192	5' 9" - 6' 4"	108 - 112	42 - 44	97 - 102	38 - 41
<b>XL</b>	176 - 192	5' 9" - 6' 4"	116 - 120	45 - 48	108 - 114	42 - 45
<b>2XL</b>	187 - 206	6' 2" - 6' 9"	124 - 128	49 - 51	120 - 126	47 - 50
<b>3XL</b>	187 - 206	6' 2" - 6' 9"	132 - 136	52 - 54	132 - 138	52 - 55

DOUBLE SIZES

Sizes (Mens)	Height		Chest		Waist	
	cm	ft and inch	cm	inch	cm	inch
<b>S/M</b>	168 - 184	5' 6" - 6' 1/2"	92 - 104	36 - 41	80 - 92	31 - 37
<b>L/XL</b>	176 - 192	5' 9" - 6' 4"	108 - 120	42 - 48	97 - 114	38 - 45
<b>2XL/3XL</b>	187 - 206	6' 2" - 6' 9"	124 - 136	49 - 54	120 - 138	47 - 55
<b>4XL/5XL</b>	187 - 206	6' 2" - 6' 9"	140 - 152	55 - 60	144 - 162	56 - 64

## BOOTS 3000 BAR SHOE SIZE GUIDE

EUR	US	UK
42	9	9
43	9 1/2	9 1/2
44	10	10
45	10 1/2	10 1/2
46	11	11
47	12	12
48	13	13

## BOOTS 500 BAR SHOE SIZE GUIDE

EUR	US	UK
36	4	3
37	5	4
38	5 1/2	4 1/2
39	6 1/2	5 1/2
40	7 1/2	6 1/2
41	8 1/2	7 1/2
42	9	8
43	10	9 1/2
44	10 1/2	10
45	11 1/2	10 1/2
46	12	11
47	13	12
48	14	13

## GAITERS SHOE SIZE GUIDE

EUR	US	UK
36 - 41	4 - 8	4 - 8
42 - 48	9 - 13	9 - 13
49 - 52	14 - 16	14 - 16

