Table 1: Overview of Ambient Conditions for els-Installation Systems

Product group / Properties	**Red series / HP** enclosures	**Abox** enclosures	**Nautic** enclosures	**WK** enclosures	**AK** enclosure system	**STV / STG** socket combinations	**HW** cavity wall installation systems	**TK (polystyrene)** empty enclosures	**TK (polycarbonate)** empty enclosures	**HF** empty enclosures	**BM** empty enclosures	**AL** empty enclosures
Ambient temperature minimum	-25°C	-25°C	-35°C	-25°C	-25°C	-25°C	-25°C	-25°C	-35°C	-25°C	-25°C	-35°C
Ambient temperature maximum	40°C	40°C	75°C	40°C	40°C	40°C	40°C	40°C	75°C	40°C	75°C	75°C
Ambient temperature mean over 24 h	35°C	35°C	60°C	35°C	35°C	35°C	35°C	35°C	60°C	35°C	60°C	60°C
Max relative humidity, @ 40°C	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Max relative humidity, @ 25°C (briefly)	100%	100%	100%	100%	100%	100%	k. A.	100%	100%	100%	100%	100%
Protection class to EN 60529 / DIN VDE 0470-1[1]	IP 54	IP 65	IP 65	IP 54	IP 65	IP 44[2]	IP 30	IP 66	IP 66	IP 66	IP 66[3]	IP 66
Impact strength to DIN EN 50102 / VDE 0470 Part 100	IK 07	IK 07	IK 08	IK 05	IK 07	IK 08	k. A.	IK 07	IK 08	IK 07	IK 08	IK 09

1) For use with suitable connectors or cable glands
2) With closed socket covers
3)When using suitably protected command/message units

Additional Information for Installation in the Open, UV Resistance:
Data on protection type and UV-resistance is frequently regarded as the only parameter for installation in the open. For installation outdoors, other factors such as absolute temperature, frequency of temperature change, relative humidity and in particular chemical influences also play an essential role.
As well as the effect from UV action, for installation outdoors, mainly damage from chemical influences should be expected. External areas of filling stations, chemical plants, refuse dumps, compressors, sewage plants etc. in particular should be studied carefully.

Table 2: Overview of Properties of Materials Used in els-Installation Systems

Material:	Used in products:	Weak acid	Strong acid	Weak alkali	Strong alkali	Alcohol	Petrol	Benzene	Mineral oil	Diesel	Ammonia	Vegetable oil	Animal oil	Free from halogens, heavy metals, PVC and silicon	Combustion behaviour to VDE 0471/UL 94	Max ambient temperature, brief (1h)	Continuous operating temperature range
Polystyrene, flame- and impact-resistant	AK system, A-box, TK-PS, HF	●	◗	●	●	●	⊗	⊗	◗	⊗	●	◗	◗	Yes[1]	960°C / V-2	+80°C	-40°C to +70°C
Polycarbonate, glass-fibre reinforced	Nautic, STV / STG, TK-PC, BM	●	●	⊗	⊗	●	●	⊗	●	◗	⊗	●	●	Yes	960°C / V-2	+130°C	-35°C to +120°C
Polycarbonate, transparent	Lid AK II, small distribution units and STV, lid AKL and TK	●	●	⊗	⊗	◗	◗	⊗	●	◗	⊗	●	●	Yes	850°C / V-2	+130°C	-35°C to +120°C
Polyethylene	Connectors, twist nipples	●	●	●	●	●	◗	⊗	◗	◗	●	●	●	Yes	650°C / HB	+100°C	-40°C to +70°C
Polyethylene, flame-resistant	Red series, box lower part	●	◗	●	◗	●	◗	◗	●	◗	●	●	●	Yes[1]	850°C / V-2	+85°C	-40°C to +70°C
Polypropylene, flame-resistant	Red series lids, HW range, HP series	●	◗	●	◗	●	◗	◗	●	◗	●	●	●	Yes[1]	960°C / V-2	+120°C	-30°C to +100°C
Polypropylene, flame-resistant, halogen-free	Halogen-free types: red series and HW	●	◗	●	◗	●	◗	◗	●	◗	●	●	●	Yes	960°C / V-2	+120°C	-30°C to +100°C
Polyurethane, version 1	Lid seal, TK, HF, BM, AKII, AKL	◗	◗	◗	◗	◗	◗	◗	●	◗	◗	●	●	Yes	650°C / —	+110°C	-35°C to +80°C
Polyurethane, version 2	Lid seal, AL	◗	◗	◗	◗	◗	◗	◗	●	◗	◗	●	●	Yes	650°C / —	+110°C	-40°C to +90°C
Aluminium Al 12 Si	AL	●	◗	●	●	◗	●	⊗	●	●	●	◗	◗	Yes	—	+130°C	-40°C to +100°C
Aminoplastic, type 131.5	WK housing	◗	◗	◗	◗	●	●	●	●	●	●	●	●	Yes	960°C / V-0	+90°C	-40°C to +70°C
Melamine resin, type 182.5	Fitting terminal blocks of WK series except 4 mm²	⊗	⊗	◗	⊗	●	●	●	●	●	●	●	●	Yes	960°C / V-0	+120°C	-40°C to +100°C
Polyamide 6, glass-fibre reinforced	Screw terminal IP 68	●	◗	●	●	●	●	◗	●	●	●	◗	◗	Yes	750°C / HB/V-2	+200°C	-30°C to +100°C
Thermoplastic elastomer	Double membrane connectors, membrane seal (A-box 025/040, 2K-12)	●	◗	●	◗	●	◗	◗	◗	◗	◗	●	●	Yes	750°C / HB	+110°C	-30°C to +80°C

● = resistant ◗ = Partially-resistant ⊗ = Not-resistant

1) The basic material is halogen-free. Low proportions (up to approx. 6%) are added to the base material to improve flame resistance.

The materials used by Spelsberg have been subjected to weather testing to DIN 53 387/1000 hour tests by the “State Testing Office in Dortmund”. The polycarbonate with 15% glass-fibre reinforcement used in the Nautic and STV series had the optimum result. This material also passed the UV resistance test to UL 746 C unconditionally.

Summary: In principle in selecting the installation site, as well as the protection class, the climatic conditions and the occurrence of chemical influences should be assessed. Data on material properties and chemical resistance of materials used is given in the tables.

Installation and Fitting Notes

1. Absence of Halogens in Installation Material

At present there are no DIN VDE regulations which specifically prescribe the use of halogen-free installation materials. Due to the lower level of toxic contaminants in the event of fire however DIN VDE 0108 gives some deviations from prescribed installation methods when halogen-free cables are used. These deviations are very particular so no detailed description is given here. (consult us for more information)
Increasingly often however regional construction rules and other regulations in the public sector (escape routes, lifts etc) require halogen-free installations. In this area the use of high quality halogen-free materials is logical. The reason is the improved protection of persons and goods in the event of fire as halogen-free materials give off little smoke on combustion, the proportion of toxic fumes is reduced to a minimum and no corrosive gases are released which could react with extinguishing agents to form hydrochloric acid. The damage to buildings and stocks is therefore reduced.

For these areas, the majority of els Installation Systems are also available in halogen-free variants, e.g. the entire Nautic range.

2. Condensation water in sealed enclosures

How does condensation water occur?
The better the seal on operating media, e.g. connection sockets and distribution housings, the earlier condensation water will form. This applies in particular at locations where changing temperatures are expected. The degree of water saturation in the air (relative humidity) is temperature-dependent. If the temperature outside the enclosure alters, the relative humidity also alters. In tightly-sealed enclosures, excess relative humidity cannot escape and condensation water occurs which is deposited in the enclosure.
The reverse occurs if inside the enclosure temperature changes occur due to heat loss e.g. devices under different loads over time. If this temperature/air humidity change is frequent, a considerable quantity of water can collect in the interior giving the impression that an otherwise sealed enclosure is not sealed. Damage occurs.

What do the safety regulations specify?
According to DIN VDE 0100-520 “Installation of heavy current systems with nominal voltages up to 1000 V, Part 5: Selection and installation of electrical operating media, chapter 52: Cable and line systems (equipment)”, precautions must be taken for water drainage if water collects or water condensation can occur within cables and line systems.

What does Spelsberg offer?
els installation systems from various products group have knock-out condensation water openings (diameter 5 mm/6 x 6 mm) on the enclosure rear or side walls. These should be opened so that when installed, they are on the underside of the enclosure so any condensation water can drain. This applies only under condition where no increased requirements for contact or external body protection are imposed (> IP 2X or dust-tight).
If requirements for contact protection or foreign body protection are also imposed on the enclosure e.g. IP 3X, we recommend the use of an ELS ventilation seal. These are available in sizes M20/Pg 13.5 and Pg 16, are fitted in the corresponding cable inlet openings on the underside and offer splash water protection up to IP X4 when properly installed.

General Notes:
Opening the holes or fitting vent seals frequently means that no condensation water will occur as the temperature and relative humidity change outside and inside the housing at the same time.
In principle, installation sites with wide temperature differences should be avoided.

Installation and Fitting Notes

3. Protection types to EN 60529/DIN VDE 0470-1

First code figure			Second code figure – Water protection								
	Contact protection	**Foreign body protection**	**IP X0** No protection	**IP X1** Protection against vertically falling dripping water	**IP X2** Protection against dripping water if housing is angled up to 15°	**IP X3** Protection against spray water from all directions even if angled up to 60° from the vertical	**IP X4** Protection against splash water from all directions	**IP X5** Protection against jet water from all directions	**IP X6** Protection against heavy jet water from all directions	**IP X7** Protection against temporary immersion in water	**IP X8** Protection against effects on long-term immersion in water
IP 0X	No contact protection	No protection against solid foreign bodies	IP 00								
IP 1X	Protection against large area contact (back of hand)	Protection against solid foreign bodies >50 mm Ø	IP 10	IP 11	IP 12						
IP 2X	Protection against contact with one finger	Protection against solid foreign bodies >12.5 mm Ø	IP 20	IP 21	IP 22	IP 23					
IP 3X	Protection against contact with tools, wires etc.>2.5 mm Ø	Protection against solid foreign bodies >2.5 mm	IP 30	IP 31	IP 32	IP 33	IP 34				
IP 4X	Protection against contact with tools, wires etc.>1 mm Ø	Protection against solid foreign bodies >1 mm	IP 40	IP 41	IP 42	IP 43	IP 44				
IP 5X	Protection against contact with tools, wires etc.>1 mm Ø	Protection against disruptive dust deposits in the inside	IP 50				IP 54	IP 55			
IP 6X	Protection against contact with tools, wires etc.>1 mm Ø	No penetration of dust	IP 60					IP 65	IP 66	IP 67	IP 68

4. Degree of Protection Against Mechanical Damage, IK Code

According to VDE 0470, part 100 “Protection types from enclosures for electrical operating media (equipment) against external mechanical damage (IK code)”, the degree of protection provided by an enclosure against mechanical damage is indicated by an IK code. The IK codes allocated to the individual stress energy values are given in the table below.

IK code	IK00	IK01	IK02	IK03	IK04	IK05	IK06	IK07	IK08	IK09	IK10
Stress energy in Joules	*)	0.15	0.2	0.35	0.5	0.7	1	2	5	10	20
*) Not covered according to the present standard.											

The data on IK values of individual ELS products is given in table 1.

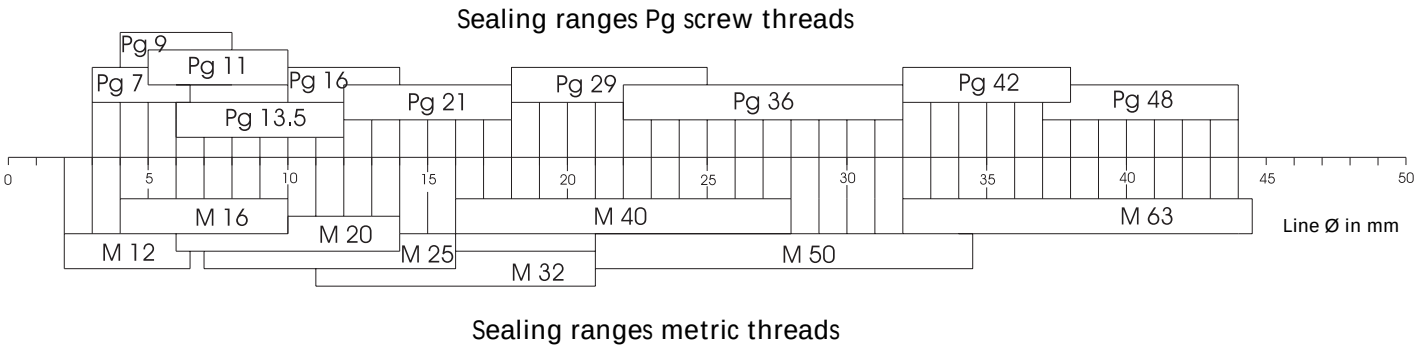
Installation and Fitting Notes

5. Conversion from Pg to Metric Sizes in enclosure knockouts and Sealing Accessories

On expiry of the transitional period on 31.12.99, DIN 46320 for screws with Pg threads becomes invalid. The Pg thread standardised since 1926 (reinforced pipe thread) is replaced by screw fittings to EN 50262 with metric thread. This new European safety standard EN 50262 for metric cable screw fittings must be applied by March 2001 at the latest. Enclosures, cable screw fittings or sealing accessories with Pg sizes will then be supplied only as replacements. The 10 sizes Pg 7 to Pg 48 are replaced by 8 metric sizes from M12 to M63. This gives a smaller range covering the same sealing ranges.
For some years Spelsberg has offered a range of metric cable screw fittings and sealing accessories. In order to use metric threads even in replacement and repair of normal sizes, Spelsberg offers adapter rings from Pg to metric size.
Spelsberg and other manufacturers will convert cable entries in enclosures (connecting sockets, distributors etc.) to metric sizes at the start of the new millennium.

Benefits for Spelsberg customers:
Because connectors and sealing plugs are provided as standard accessories for many els brand products, conversion is easy for the customer. On purchase he always obtains the corresponding metric accessories. The precise marking of the sealing elements and housings makes the problem even easier.
Openings in els housings size Pg 13.5 are now designed and marked so that an M20 screw fitting can be inserted.

Comparison of sealing ranges using the example of els cable gland IP 68:



Specifications and Conformity to Standards

Development, testing and production to national and international regulations and special licences document the high safety standard of els brand products.

Quality management system to DIN EN ISO 9001
Registration no. 2923 / QM 02.97 (AA) of the VDE Test and Certification Institute

DIN VDE 0606 Part 1
'Installation sockets for equipment and/or connecting clamps'

IEC 998-2-5 / VDE 0606 Part 101
'Connectors for low voltage circuits for domestic and similar purposes'

IEC 670
'General requirements for enclosures for accessories for household and similar fixed electrical installations'

DIN EN 60999 VDE 0609 Part 1
'Safety requirements for screw terminals and screwless terminals for copper electrical leads'

DIN EN 60998 Part 1, Part 2-1 / VDE 0613 Part 1, Part 2-1, Part 2-2
'Connectors for low-voltage circuits for domestic and similar purposes'

DIN EN 60947-7-1, VDE 0611 Part 1
'Low voltage switchgear, Part 7, auxiliary devices, main section one, terminal blocks for copper cable'

DIN VDE 0603 Part 1
'Installation small distributor and counters AC 400 V'

DIN VDE 0603 Part 2
'Mains cable branch terminals'

The data from DIN VDE standards by the VDE standards body have been taken with the permission of the DIN German Standards Institute and the VDE Association of German Electrical Engineers. They correspond to the status of the German Standards / VDE Specifications at 01.06.2000.

DIN EN 50298 / VDE 0660 Part 511
'Empty enclosures for low-voltage switchgear combinations, general requirements'

DIN EN 60439-1 / VDE 660 Part 500
'Low voltage switchgear combinations'

UL 50
'Enclosures for Electrical Equipment, Eleventh Edition'

UL 746C
'Standard for safety polymeric materials – use in Electrical Equipment evaluations'

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