

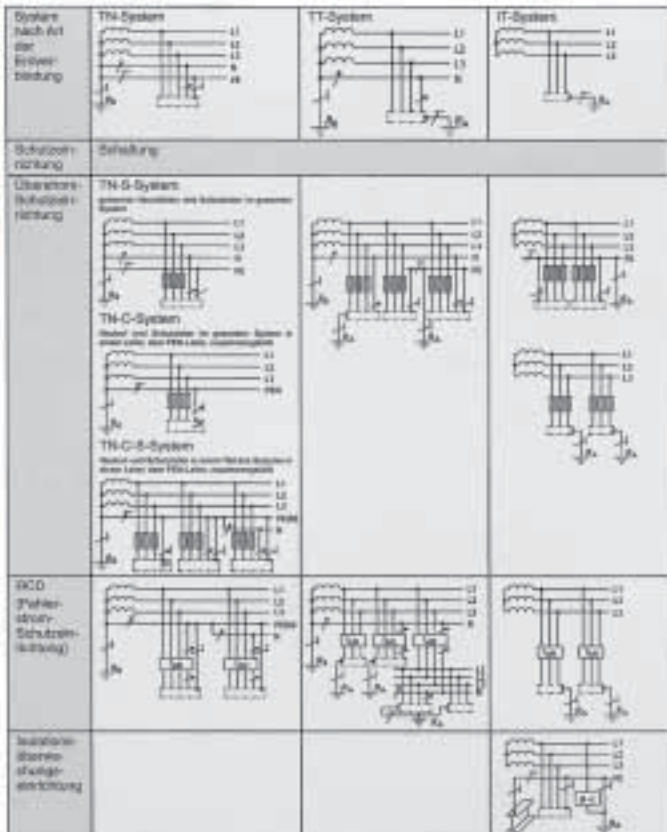
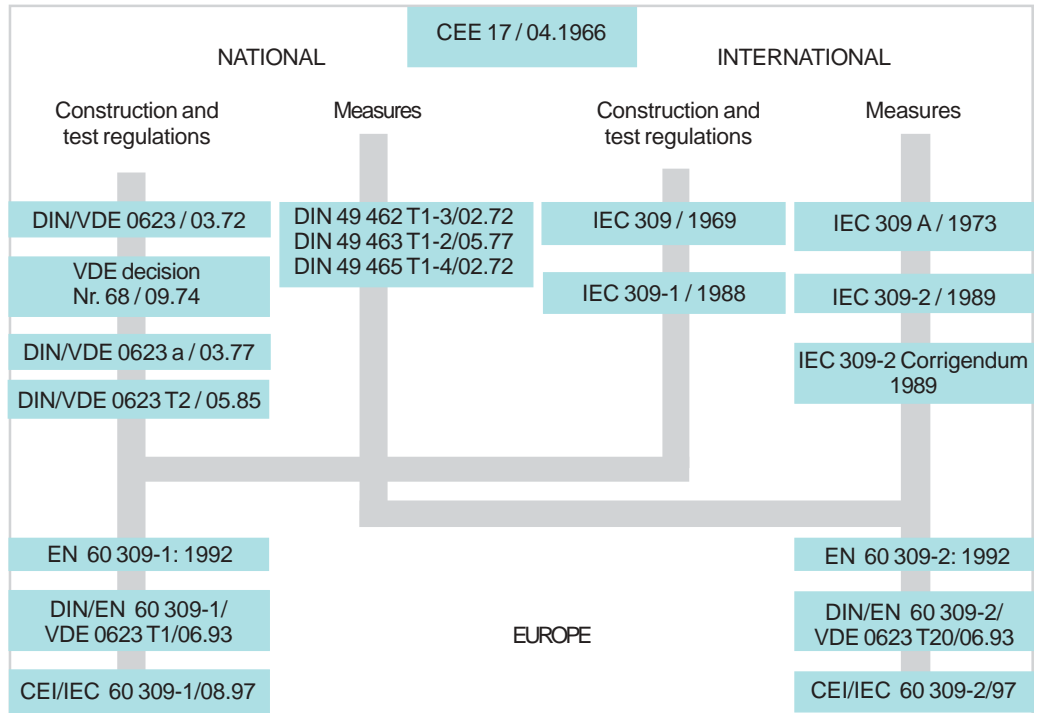
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Development of standards for CEE plugs and sockets

- CEE - International Commission on Rules for Approval of Electrical Equipment
- IEC - International Electrotechnical Commission
- CEI - Commission Électrotechnique Internationale
- DIN - Deutsches Institut für Normung
- VDE - Verband deutscher Elektrotechniker
- EN - Europäische Norm



Protective systems for use against electric shock under error conditions (protection against indirect contact) in the systems according to type of earth connection

The used symbols have the following meaning:

- First letter - Relation of the supply system to earth
- T direct connection of a point to earth
- I either all active parts separated from earth or one point connected with earth via impedance.

Second letter - relation of the item of the electrical equipment to earth.

- T item directly earthed, independent from a possible earthing of a point of the supply system.
- N Item directly connected with the earthed point of the supply system (in alternating current mains the earthed point generally is the star point, or, if a star point does not exist, an outside conductor).

Additional applicable letters - position of neutral and earth

- S The safety function is guaranteed by a conductor which is separated from neutral and the earthed outside conductor (in direct current systems earthed negative or positive conductor).

- C Neutral and earth conductor functions combined in one conductor (PEN conductor).

Explanation of symbols according to IEC 617-11: 1993

- Neutral (N)
- Earth (PE)
- PEN-conductor:
Combination of earth and neutral (PEN)

Regulations

WALTHER CEEtyp plugs and sockets are according to international standards IEC/EN 60 309-1/08.97 and 60 309-2/97.

These standards were developed as a successor of the European Standard CEE 17. European and national standards were superseded by international standards.

Industrial installation

According to DIN/VDE 0100 T 550 for German industrial plants since 01.01.1981 the connection of the electrical consumer to the network is only allowed with CEEtyp plugs and sockets.

In most of the countries worldwide CEEtyp plugs and sockets are introduced in addition to eventually other existing products. For special applications in industrial areas the following additional standards, requirements and practical information could be useful:

Construction sites

Manufacturer standards for assemblies for construction sites

1. DIN/VDE 0612/05.74 was valid on itself until 30.11.1991

2. IEC/EN 60439-4:1990 (DIN/VDE 0660 T501/02.92), is valid since 01.12.1991. For the changeover a transition period till 30.11.1996 was fixed. The fabrication of assemblies for construction sites does thus no longer comply to the standard DIN/VDE 0612.

3. IEC/EN 60439-4/A1 (DIN/VDE 0660 T501/A1:1996-12), valid from 01.09.1996. Valid on itself from 01.09.2001. Thus the IEC/EN 60439-4:1990 might still be applied for fabrication until 31.08.2001 (see BG-regulations).

4. IEC/EN 60439-4/A2. This modification was passed on 01.08.1999. For Germany a summarised version of the modification called DIN/VDE 0660 part 501:2000-05 was published. This will be valid on itself from 01.08.2002.

The most important modification in the IEC/EN 60439-4/A1 is ...

... the demand to protect all plugs and sockets $\leq 32A$ with an RCD $I_{FN} \leq 30mA$. (RCD = residual current device).

This demand is identical with the definitions in IEC/EN 60364-7-704:1989. The demand of the ZH1/271 section 8.2 regarding the RCD $I_{FN} \leq 30 mA$ refers to the first use of brand-new distributors, not to the putting into operation of existing distributors on a new construction site. Section 8.3 covers existing distributors which were first used before the 01.01.1999, no matter when they were put into operation on the current construction site.

User standards for electrical systems on construction sites

1. DIN/VDE 0100 part 704/11.87, still valid at present.

2. IEC/EN 60364-7-704:1989 (HD 384.7.704 S1:1999) (VDE 0100 Teil 704:200?-??) This international standard will only be valid on itself on 01.08.2002. The German version is supposed to be published at the beginning of 2001.

3. BG regulations (ZH 1/271 version 12/97). Safety and health protection regulations in case of selection and operation of electrical systems and production facilities on construction sites. Actually for the practitioner these regulations are a useful summary of the DIN VDE. Additionally definitions are made regarding topics which are not dealt with in the new DIN/VDE 0100 T704.

4.2.6 Protective measures for frequency-controlled production facilities
4.3.2 Smallest assemblies for construction sites
8. Transition regulations. This applies accordingly: From 01.01.1999 on new distributors have to be equipped according to IEC/EN 60439-4/A1, i.e. before the date indicated in the standard. There only 01.09.2001. From 01.01.2002 on existing distributors must be refitted according to IEC/EN 60439-4/A1.

Safe quality

Since many years now the high quality standard of Walther products is ensured by a special quality management department. The quality management system regulates and optimizes the internal processes and gives the market partners the security to be in safe hands.

Technical types of assemblies for construction sites

Connection cabinet resp. connection distribution cabinet

- Series WA and WAV
- Rating of 55 up to 436kVA
 - with NH-fuse-switch disconnector for incoming power
 - with uptakes for measuring devices like meters and converters
 - with NH-fuse-switch disconnectors with fuses for branch branch lines to subordinate ACS
 - as connection distribution cabinet with additional sockets up to 125 A or terminals



Group / main distribution cabinets series WGV

- Rating from 173 - 436 kVA
- with NH-fuse-switch disconnector for incoming power
- with NH fuse-switch disconnectors or NH switch disconnectors with fuses for branch lines to subordinate ACS

Connection distribution cabinets series WV

- Rating from 24 - 277 kVA
- With NH fuse-switch disconnector for the supply from the connection cabinet or group distributor
- With sockets up to 125 A and terminals

End / socket distributors series WEV, 654, 656, 6BT and 649

- Rating from 3,7 - 44 kVA
- With CEE appliance inlet for the supply from the connection cabinet or connection distribution cabinet
- Optionally with KWH meter
- With sockets up to 63 A

Power supply planning

Three criteria affect the electrically correct and reasonably priced planning of a construction site power supply:

- the provisions of the power-supply company
- the valid regulations
- the construction site requirements

Parameters which determine the planning of a construction site power supply ...

- responsible power-supply company
- total output requirements of the construction site
- Type and number of machines and devices
- Distances from one machine to the other and to the power supply of the construction site and the resulting power losses lead to the right assembly for construction sites.

Electrical installation on farms

Unfortunately there is no international standard especially for farms. In Germany the special standard DIN/VDE 0100 T 705 / 10.92 is dealing with electrical installation on farms. Electrical supply systems with sockets in TN-, TT-, IT-networks have to be protected by a residual-current device with a rated residual operating current of $I_{\Delta n} \leq 30$ mA. This RCD has to be operated at least once a month and in addition after thunderstorms. The IP degree of the installation should be at least IP 44, in areas with intensive dust IP 54. We recommend our CEEtyp plugs and sockets for harsh environments on farms and other areas with dust or other aggressive and corrosive atmospheres. In Germany and other DIN/VDE related countries the DIN/VDE 0105 T 15 is applicable for farms and farming areas and requires among other items the following:

4.5 Plugs and sockets

4.5.1 Plugs and sockets according to IEC/EN 60 309, DIN/EN 60 309 shall be used.

4.5.2 Plugs and sockets shall be protected against humidity and damage. Keys and keyways on these systems shall not be destroyed to allow misuse. Damaged plugs and sockets shall not be used.

4.5.3 Damaged or destroyed plugs and sockets shall be replaced by a skilled person¹⁾.

4.5.5 Plugs and couplers shall not be pulled off their counterparts through their cables.

Note¹⁾:

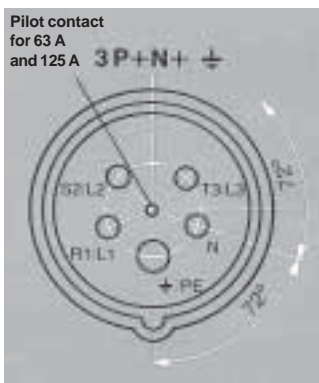
According to DIN/EN 50110-1/EN 50110-1 (1996/07/02) a skilled person is a person with relevant education experience to enable him or her to avoid dangers which electricity may create (IEV 826/09/01 modified). In DIN/VDE standard it is additionally clarified that such a skilled person should be registered with the electrical supply authority as a skilled person if dealing with electrical installation on farms.



CEE-clock

Circuits with voltages above 50 V shall have an earthing contact. The earthing contact, the phases and a neutral, if any, are arranged on a circle. The earthing contact has the largest diameter.

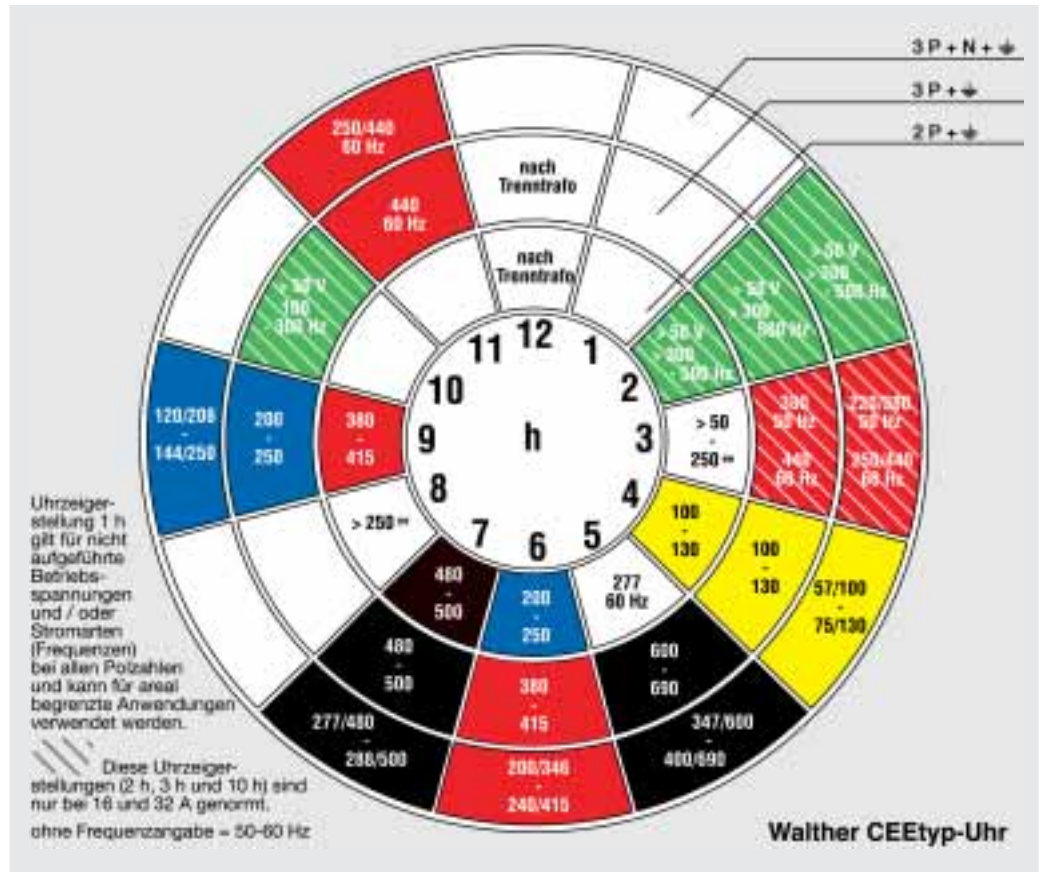
The diameter of the earthing contact is dimensioned in a way that prevents contact with other pins through the isolating material.



Position of the contact sleeves and terminal markings at 6 hour position

The earth contact makes first and breaks last. All CEEtyp plugs and couplers also have an extended earth contact on the back of the insert which prevents in an unlike event separation of the conductor loop from the earth

The earth position is determined by looking into a socket from the front with the keyway at the bottom 6 o'clock. The voltage and the frequency then determine the hour position of the earth. This prevents the possibility of connecting items of different voltages or frequencies in accordance with IEC 60 309-1.



If the earthing-contact-coded voltage is colour-coded, then the colours as indicated in IEC/EN 60 309-1/08.97 have to be used.

1) For frequencies over 60 Hz up to 50 Hz , the colour green may be used, if necessary, in combination with the colour for the rated operating voltage.

2) In countries where accessories of series II current ratings are used, the colour orange is reserved for 125/250 V~ AC and the colour grey is reserved for 277 V~ AC accessories.

Rated operating voltage V	Colour ¹⁾²⁾
100 to 130	Yellow
200 to 250	Blue
380 to 480	Red
500 to 690	Black

Source: IEC/EN 60 309-1/11.98 table 2

Materials

Enclosures and contact carriers

are serially made of high-quality self-extinguishing plastic material which is free from cadmium, PVC and halogene. Suitable for ambient temperatures of - 25 °C up to + 100 °C under load.

Normally CEEtyp plugs and sockets are made of polyamide. The enclosures of combination units are made of PC/ABS, solid rubber or hard polyethylene.

For special applications like extreme heat, cold, or to increase chemical resistance, WALTHER also supplies units made of special plastic materials.

Contacts

are made of brass. For plugs and sockets for voltages lower than 50 V, watertight (IP 67) plugs and sockets, Mondo plugs and sockets as well as plugs and sockets for harsh environments the contacts are nickel-plated. All steel components such as screws and springs are zinc-plated and blue-chromed or nickel-plated.

The cross-sectional areas of the terminals are in accordance with IEC/EN 60 309-2/97 table 107. The temperature rise of a contact may be + 50 °C under the test conditions being determined in table 8.

Size of connectable conductors

Ratings of the plugs and sockets		Internal connection ¹⁾							External earthing connection (if any)		
Voltage V	Rated current A		Flexible cables for plugs and couplers, solid or stranded cables for appliance inlets ²⁾			solid or stranded cables for sockets ²⁾					
	series I	series II	mm ²	AWG	Terminal size	mm ²	AWG	Terminal size	mm ²	Terminal size	AWG
Not exceeding 50	16	20	4 - 10	12-8	6	4 - 10	12-8	5			
	32	30	4 - 10	12-8	6	4 - 10	12-8	5			
Exceeding 50	16	20	1 - 2,5	17-13	2	1,5 - 4	16-12	3 ³⁾	6	4	10
	32	30	2,5 - 6	13-10	5	2,5 - 10	13-8	5	10	5	8
	63	60	6 - 16	10-6	7	6 - 25	10-4	7	25	7	4
	125	100	16 - 50	6-1/0	9 ⁴⁾	25 - 70	4-2/0	9 ⁴⁾	25	7	4

Source: IEC/EN 60 309-2/97, table 107

¹⁾ Terminals for pilot conductors, if any, shall allow the connection of conductors having the same nominal cross-section areas as the terminals of 16 A accessories having rated operating voltages exceeding 50 V.

²⁾ Classification of conductors: According to HD 383 S2 § 2 solid (class 1); stranded (class 2); flexible (class 5).

³⁾ for connecting blocks, terminal size 2

⁴⁾ For the time being there is no conformity with terminal size 9 required.

Preferred rated current Series I/II		Test current	Cross-sections of conductors			
			Plugs, appliance inlets and couplers		Sockets	
Duration	A	A	mm ²	AWG	mm ²	AWG
1 h	16/20	22	2,5 ¹⁾	13	4 ¹⁾	12
1 h	32/30	42	6 ¹⁾	10	10	8
2 h	63/60	rated current	16	6	25	4
2 h	125/100	rated current	50	1/0	70	2/0

Source: IEC/EN 60 309-1 08.97 table 8

¹⁾ For accessories having a rated operating voltage not exceeding 50 V, the values are increased to 10.

Material properties

Protection degrees

	PC/ABS	Polyamide	Rubber	Polyethylene	Polystyrene	PBT at 23°C	PBT at 60°C	Stainless steel (IV 1.4301)
Chemical resistance								
1. Hydrocarbons								
n-Hexane	O	+	-	+	+	+	+	◇
four star petrol, containing aromatic chemicals	-	+	-	+	-	+	O	+
heating oil	O	+	O	+	O	+	+/O	+
gasoline for cleaning purposes (free of aromatic chemicals)	O	+	O	O	O	+	O	+
benzol	-	+	-	+	-	+	-	+
naphthalene	-	+	-	+	O	+	O	◇
nitro benzol	-	+	-	O	-	O	O	◇
toluol	-	+	-	+	-	+	-	+
2. Alcohols								
ethyl alcohol, 96%	O	O	+	+	O	+	O	+
isopropanol	O	O	+	O	+	+	O	◇
phenol	-	-/Δ	-	+	O	-/Δ	-/Δ	O
glykol	O	O/Δ	+	+	+	O	-	◇
glycerine	O	+	+	+	+	+	+	+
3. Ketones								
acetone	-	+	+	+	-	+	-	+
methyl isobutylketon	-	+	-	O	-	+	O	◇
4. Acids (max. concentration)								
hydrochloric acid (20%)	+	-	O	+	+	O	-	-
nitric acid (10%)	+	-	O	O	O	+	O	+
phosphoric acid (30%)	+	-	+	+	+	+	O	+
sulfuric acid (30%)	+	-	+	+	+	O	-	O
citric acid (10%)	+	+	+	+	+	+	O	+
lactic acid (10%)	+	+	+	+	+	+	+	+
acetic acid (10%)	+	O	-	+	+	+	O	+
oleic acid	-	+	-	+	+	+	O	O
5. Bases								
aniline	-	O	-	+	-	O	-	+
sodium hydroxide (10%)	-	+	+	+	+	O	-	◇
ammonia solution, diluted	-	+	+	+	+	O	-	+
6. Halogenes								
bromine	-	-	-	-	-	◇	◇	-
chlorine	-	-	-	+	-	◇	◇	O
iodine	-	-	+	+	O	◇	◇	O
7. Oils, greases								
soybean oil	-	+	-	+	+	+	+	+
olive oil	-	+	-	+	+	+	+	+
lard	-	+	-	+	+	+	+	+
butter	-	+	-	+	+	+	+	+
8. Salt solutions								
potassium carbonate, saturated	-	+	+	O	+	+	O	+
sodiumthiosulfate	+	+	+	+	+	+	O	+
sodium hypochloride	+	-	-	O	+	+	+	O
sea water	+	+	+	+/O	+	+	+	+
9. Detergents								
curd soap solution, 2%	+	+	O	+	+	+	+	+
washing power, e.g. "Persil"	O	+	+	+	+	+	+	+
cleaning agent, e.g. "Dor"	+	+	O	+/O	+	◇	◇	+
10. Other media								
diethyl ether	-	+	-	+	-	+	O	◇
urea	+	O	+	+	+	◇	◇	+
trichloric ethylene	-	O	-	+	-	O	-	+
hydrogen superoxide, 30%	+	O	-	O	+	+	O	O

- + = resistant
- O = conditionally resistant
- = non-resistant
- Δ = soluble
- ◇ = no test results available yet

IEC/EN 60 529, DIN/VDE 0470 T1 / 11.1992.

The type of protection is indicated by the IP code.
(IP = International Protection)

Component	Digits or letters	Protection of equipment	Protection of persons
Code letters	IP		
First digit	0	Protection against ingress of solid foreign objects	Protection against touching with:
	1	(not protected)	(not protected)
	2	≥ 50 mm diameter	Hand
	3	≥ 12,5 mm diameter	Finger
	4	≥ 2,5 mm diameter	Tool
	5	≥ 1,0 mm diameter	Wire
	6	dust protected	Wire
Second digit	0	dust proof	Wire
	0	Protection against the penetration of liquids	
	1	(not protected)	
	2	vertical dripping	
	3	dripping (15° angle)	
	4	spraying water	
	5	splashing water	
	6	water jets	
	7	heavy seas	
8	immersion of water		

Source: DIN/VDE 0470 T 1/11.92

Note:

According to the standard IEC/EN 60 309 CEEtyp plugs and sockets have the following **protection degrees**:

16 - 63 A: IP 44 and IP 67

125 A: only IP 67

zone 11: at least IP 54 acc. to DIN/VDE 0165-2.91

Construction and test regulations, approvals

WALTHER CEEtyp part number system

CEE plugs and sockets are constructed according to the following standards:

IEC/EN 60 309-1/08.97 and IEC/EN 60 309-2/97
 DIN/EN 60 309-1/VDE 0623 T1: 1993-06
 DIN/EN 60 309-2/VDE 0623 T20: 1993-06

Three different approvals are applied worldwide:

National Approval

An electrical device is only submitted for testing in one country and therefore is only allowed to carry the certificate of the relevant country after successful testing.

European Approval

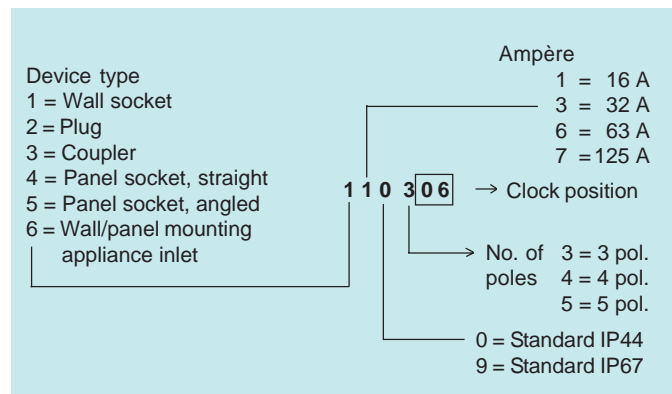
The national testing authorities in Europe founded a European Committee for electrotechnical standardisation named CENELEC (CENELEC = Comité Européen de Normalisation Electrotechnique).

All members are requested to transform the CENELEC standards - European Standards (EN) - in national standards without any changes. This applies to Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Italy, Luxemburg, The Netherlands, Norway, Portugal, Spain, Sweden and Switzerland. After successful testing according to the EN standards in one of the a.m. countries a CCA test report will be issued. This report can be submitted to every country on application for the relevant national standard.

Worldwide valid approvals

All countries in the world are interested in producing easily exchangeable goods because of their close business relationships. Therefore the IEC (= International Electrotechnical Commission) was established. This committee develops IEC Standards on which the testings of the national member states are based. After successful testing a CB test report will be established which can also be used for the application of national certificates.

WALTHER products have more than 6000 approvals worldwide.



For standard versions (5pole, 6h position) only the first three digits are used.

Other numbers are article-specific.



Conform with Low Voltage Directive



Breaking capacity

If a plug and a socket are used without interlock they can be operated under load. If they are operated under load they shall have an adequate breaking capacity. The test is made according to IEC/EN 60 309-1/11.98.

The products are tested at 1.1 times rated operated voltage and 1.25 times rated current with power factor $\cos \varphi$ according to table 6, the speed of insertion and separation of the plug or connector shall be $0,8 \pm 0,1$ m/s at 7.5 strokes per minute. After the test the products shall not show any damage impairing their future use and the entry holes for the plug contacts shall not show any serious damage.

Breaking capacity

Rated current A			Number of cycles		
Preferred ratings		Other ratings	AC		DC
Series I	Series II	Range	$\cos \varphi \pm 0,05$	under load	under load
16	20	up to 29	0,6	50	50
32	30	30 - 59	0,6	50	50
63	60	60 - 99	0,6	20	20
125	100	100 - 199	0,7	20	20

Source: IEC/EN 60 309-1/08.97 table 6

Interlocks

An interlock shall be incorporated in sockets and connectors not complying with the tests for breaking capacity and normal operation according to the standard. Interlocks shall be linked with the operation of a switching device so that the plug can neither be withdrawn from the socket or connector while the contacts are alive, nor be inserted while the switching device is in the "ON" position. There are two different types of interlocks:

1. Mechanical interlocks

Sockets with switches. Mechanical switching devices for interlocked AC switched sockets or connectors shall comply to IEC/EN 60 947-3: 1992 table 2 with a utilisation category of at least AC 22 A. Mechanical switching devices for interlocked DC switched sockets or connectors shall comply to the same standard with a utilisation category according to the application. All CEEtyp interlocked devices have a double interlocking feature where the switch can only be withdrawn when the switch is in the „OFF“ position.

2. Electrical interlocks

The last make and first break pilot contact for 63 and 125 A provides in combination with a switching device an insertion and withdrawal of a plug under load. The integral switching device shall comply with the tests for breaking capacity and normal operation.

Normal operation

Plugs and sockets shall withstand, without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring in normal use. After the test acc. to IEC/EN 60 309-1/11.98 with the values according to table 7, the products shall not show any wear or damage impairing the further use of the product. Products are tested at rated operating voltage and rated current.



Normal operation

Rated current A			Number of cycles at 7,5 strokes per minute				
Preferred ratings		Other ratings	AC			DC non-inductive	
Series I	Series II	Range	$\cos \varphi \pm 0,05$	under load	off load	under load	off load
16	20	up to 29	0,6	5000	-	5000	-
32	30	30 - 59	0,6	1000	1000	1000	1000
63	60	60 - 99	0,6	1000	1000	500	500
125	100	100 - 199	0,7	250	250	250	250

Source: IEC/EN 60 309-1/08.97 table 7

Plugs and sockets for USA and Canada

UL 1682 and UL 1686 C2

In North American countries other voltage systems are used.

The phase markings are:

L1 = X, L2 = Y, L3 = Z,

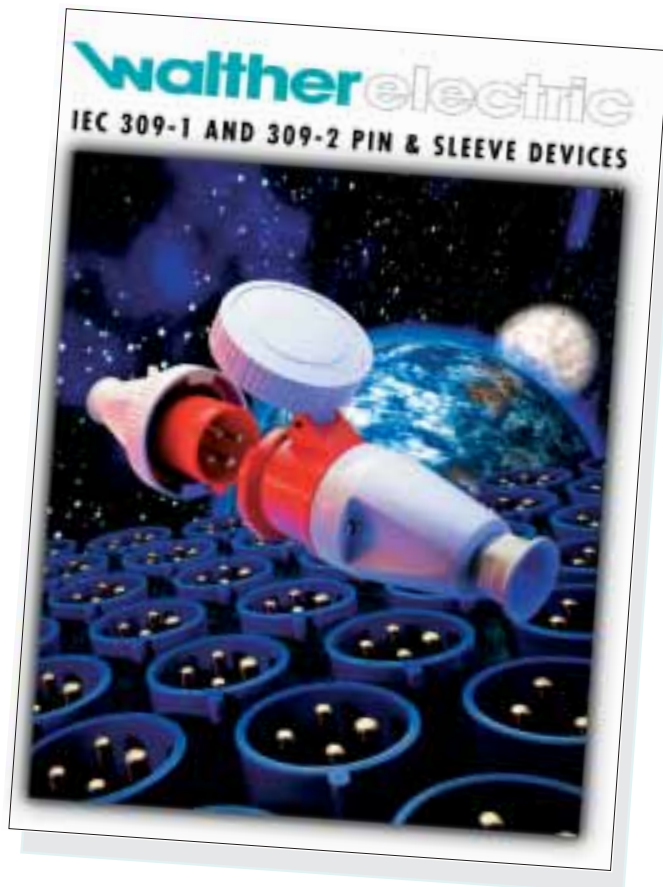
Neutral N = W
or white spot,

Earth \oplus = G
or green spot.

The rated current ratings are 20, 30, 60 u. 100 A.

North American Ratings:

2 poles - 3 wire (3pole) Volt Clock position Identifying colour	125 V AC 4	250 V AC 6	277 V AC 5	480 V AC 7
	yellow	blue	grey	red
250 V DC - 3 h - blau				
3 poles - 4 wire (4pole) Volt Clock position Identifying colour	125/250V AC 12	3Ø250 V AC 9	3Ø480 V AC 7	3Ø600 V AC 5
	orange	blue	red	black
4 poles - 5 wire (5pole) Volt Clock position Identifying colour	3ØY120/208 V AC 9	3ØY 277/480 V AC 7	3Ø 347/600 V AC 5	
	blue	red	black	



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