CURRENT TRANSFORMERS

Current Transformers (CT)

FAT - 30B

FAT - 30C

FAT - 30

FAT - 40

FAT - 40C

FAT - 60

FAT - 100

FAT - 130

TS EN 61869 - 1
TS EN 61869 - 2
CE

Mounting Position	**:** Free
Altitude	**:** 1000 m (max)
Relative Humidity	**:** 90% (max)
Ambiance Temperature	**:** Between -25°C and +60°C
Protection Degree	**:** IP20

All these given information are general. We have always right to change them.

FEDERAL

Low voltage current transformers; consist of three parts as primary winding, secondary winding and magnetic core which those windings are wound on. There is no primary winding in current transformers without busbar in primary. Instead, primary winding is formed by passing busbar or cable through toroidal core of the transformer. Federal current transformers are manufactured in accordance with CE. Federal current transformers can be sealed.

Measure current transformers:
Measure current transformers have been formed to feed measurement tools, counters, relays and other devices operating with similar techniques. These are the transformers which insulate such devices from high voltage networks and which reduce currents out of limits of measurement devices to measurable values.

Explanations of technical terms used in current transformers:
Primary winding (P1, P2): This is the winding passing the current to be transformed.

Secondary winding (S1, S2): This is the winding feeding current circuits of current transformer, measurement tools, counters, relays and similar devices.

Primary rated current (Ipn):
This is the current which is taken as the basis in manufacture of the current transformer and which determines normal operating conditions of the transformer.

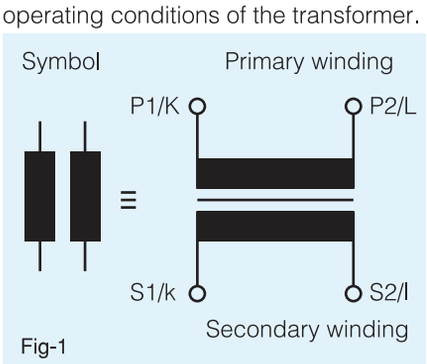


Fig-1

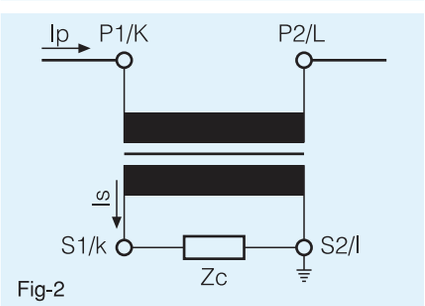


Fig-2

Secondary rated current (Isn):
This is the current which is taken as the basis in manufacture of the current transformer and which determines normal operating conditions of the transformer.

Rated transformation proportion (Kn):
This is the proportion between the primary rated current and the secondary rated current.

$$Kn = \frac{Ipn}{Isn}$$

Short-term thermal rated current (Ith):
This is the effective value of the primary current, which the secondary of the current transformer can resist for 1 second without any damage in short circuit condition.

Dynamic rated current (Idyn):
This is the peak value of the primary current, which the secondary of the current transformer can resist without any electrical or magnetic damage due to electromagnetic forces in short circuit condition.

Safety coefficient in measurement tools (Fs):
Safety is expressed as the proportion of the primary current to the primary rated current.

$$Fs = \frac{Ips}{Ipn}$$

Here;
Ips = Safety primary current
Ipn = Primary rated current

In case of a short circuit in the network to which the primary winding is connected, safety of the tools fed by the current transformer is higher as the Fs coefficient is lower.

Compound error (oc) :
Provided that assumptions in marking of positive ends of primary and secondary currents are complied with, this is the effective value of the difference between rated transformation proportion and multiplication of instant values of the primary current and instant values of the secondary current in continuous operations. The compound error is generally given as % of the effective value of the primary current with the formula below.

$$\varepsilon c = \frac{100}{Ib}\sqrt{\frac{1}{T}\int(Kn.Is-Ip)^2 dt}$$

Here;
Kn= Rated transformation proportion
Ib= Effective value of the primary current
Ip= Instant value of the primary current
Is= Instant value of the secondary current
T= Duration of a period

Current error (Transformation proportion error) (o1) :
This is the error arising in measurement of the current due to inequality of the transformation proportion of the transformer to the rated transformation proportion. The current error is found with the following equality in percentage.

$$\varepsilon_1 = \frac{Kn \times Is - Ib}{Ib} \times 100\ (\%)$$

Here;
Kn= Rated transformation proportion
Ib= Primary current
Is= This is the equivalent secondary current when Ip passes through the primary winding during measurement.

Phase shift (o) :
Provided that direction of the current vector is selected to have zero phase difference in an ideal transformer (with zero loss), this is the phase difference between vectors of primary and secondary currents in any current transformer. If phase of the secondary current vector is in front of phase of the primary current vector, the phase difference is positive; if it is behind, the phase difference is negative.

Load (Zc):
Provided that power coefficient is stated, this is the impedance of the secondary current expressed in ohms (or in volt amperes in rated secondary current). Load is generally expressed with apparent power, which is taken at a particular power coefficient and secondary rated current and which is stated in volt ampere.

Rated output power:
This is the apparent power, given by the current transformer to the secondary current at a particular power coefficient, secondary rated current and rated load and expressed in volt amperes.

$$Pc = Zc \times Isn^2\ (VA)$$

Accuracy class (CL):
This is a term used to describe that the error in current transformers remains within particular limits. Accuracy class of measurement current transformer is given with a number called "class index" in percentage which is equal to top limit of the current error in primary rated current and rated load. Standard value is 0,1 - 0,2 - 0,5 - 1 - 3 - 5. Accuracy class of the protection current transformer is given with a number called "class index" and a following "P" letter expressing the top level of the compound error in rated current and rated load. Standard value is 5P and 10P.

Current error limits (for classes 3 and 5):

Accuracy class	±% current error for the current value expressed in percentage of the rated current	
	%50	%120
3	3	3
5	5	5

Highest network voltage (kV)	One-minute duration network resistance voltage (kV)	Impulse withstand voltage (kV)
0,6	3	-
1,2	6	-
2,4	11	-
3,6	16	45
7,2	22	60
12,0	28	75
17,5	38	95
24,0	50	125
36,0	70	170

Current error and phase shift limits (for classes 5P and 10P):

Accuracy class	Current error % in primary rated current	Phase shift in primary rated current		Compound error % in rated accuracy limit primary current
		Minutes	Centi-radians	
5P	±1	±60	±,18	5
10P	±3	—	—	10

Rated insulation level:
This is the effective value of the large voltage in KV at any time and any point of the network between phase conductors of the network (except temporary voltage changes in case of instant cut-out of significant loads and failures).

Impact voltage test :
This is the test carried out to determine impact voltage resistance of primary circuits of the current transformers employed in outside facilities.

Network frequency voltage test:
This is the application of network frequency voltage value, which is the equivalent of the rated insulation level, to the transformer for 1 minute by connecting the primary winding and all the parts belonging to it. This is the application of a particular voltage value at high frequency (100 Hz - 200 Hz) for a duration calculated according to the frequency.

Current error and phase shift limits (0,1 - 0,2 - 0,5 - 1 classes according to TS EN 61869-2):

Accuracy class	Current (proportion) error ± percentage for the rated currents given below					± phase shift for rated current percentages given below									
						Minutes					Centi-radians				
	% 1	% 5	% 20	% 100	% 120	% 1	% 5	% 20	% 100	% 120	% 1	% 5	% 20	% 100	% 120
0,1	-	0,4	0,2	0,1	0,1	-	15	8	5	5	-	0,45	0,24	0,15	0,15
0,2s	0,75	0,35	0,2	0,2	0,2	30	15	10	10	10	0,9	0,45	0,3	0,3	0,3
0,2	-	0,75	0,35	0,2	0,2	-	30	15	10	30	-	0,9	0,45	0,3	0,3
0,5s	1,75	0,75	0,5	0,5	0,5	90	45	30	30	60	2,7	1,35	0,9	0,9	0,9
0,5	-	1,5	0,75		0,5	-	90	45	30	60	-	2,7	1,35	1,35	0,9
1,0	-	3,0	1,5	1,0	1,0	-	180	90	60	60	-	5,4	2,7	1,8	1,8

When current fault and phase shift at rated frequency varies between 1/1 and 1/4 of the secondary load, rated load, the values in the table should not be exceeded.

Powers of devices connected to current transformers:

Devices	Power VA)
Ammeter (soft iron)	0,7 ... 1,5
Watt meters	0,2 ... 5,0
Cosφ meters	2,0 ... 6,0
Counters (active and reactive)	0,4 ... 1,0
Reactive power control relays	0,5 ... 1,0
Over current relays	0,2 ... 6,0
Reverse current relay	1,0 ... 2,0
Secondary thermal relay	7,2 ... 9,0

Additional loads arising from copper cables:
Power loss in cable with secondary current as 5 A (VA)

Cable (Cu)	2,5 mm²	4,0 mm²	6,0 mm²	10,0 mm²
1 m.	0,36	0,22	0,15	0,09
2 m.	0,71	0,45	0,30	0,18
3 m.	1,07	0,67	0,45	0,27
4 m.	1,43	0,89	0,60	0,36
5 m.	1,78	1,12	0,74	0,44
6 m.	2,14	1,34	0,89	0,54
7 m.	2,50	1,56	1,04	0,63
8 m.	2,86	1,79	1,19	0,71
9 m.	3,21	2,01	1,34	0,80
10 m.	3,57	2,24	1,49	0,89

Power loss calculation of cable:

$$P = \frac{I_{sn}^2 \times 2L}{Sx56} \text{ (VA)}$$

L = Length of the cable on secondary side (m)
Isn = Secondary rated current (A)
S = Section of copper cable (mm2)
P = Power loss (VA)

For example; The load coming to the current transformer for an active, a reactive counter and 4 m 2,5 mm2cable is 1+1+1,43 = 3,43 VA. Here, it would be suitable to use a current transformer of 5 VA.

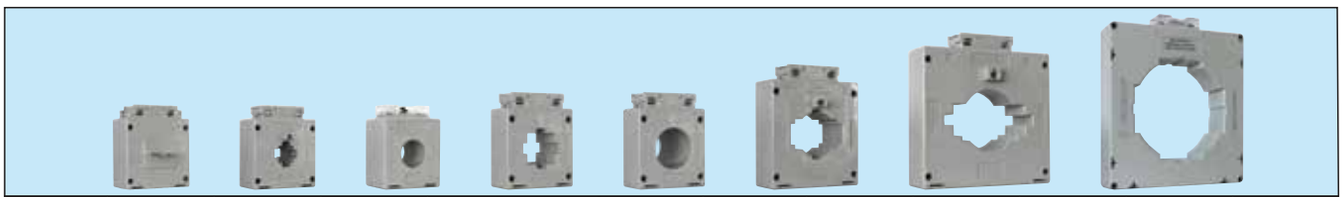
Technical Features :

Highest network voltage	: 720 V
Place of use	: Inside building
Continuous operating voltage	: 1,2xIn
One-minute duration test voltage	: 3 kV
Safety coefficient	: <5, <10
Nominal primary current	: 30A....4000A
Nominal secondary current	: 1A, 5 A
Operating frequency	: 50-60Hz
Operating temperature	: -25°C + 60°C
Thermal rated current	: 100xIn (FAT30,FAT30C) 60xIn (FAT30B) 50kA (FAT40, FAT40C, FAT60, FAT100, FAT130)
Dynamic rated current	: Idyn= 2,5xIth
Insulation Category	: E, F, H

Important considerations in assembly of current transformers:
- While current passes through the primary, the secondary circuit should not be opened.
- Primary ends of current transformers are shown with letters K-L, secondary ends are shown with letters k-l.
- Current transformers are made as one-phased.
- Current transformers are devices that usually operate in case of short circuit. (*)

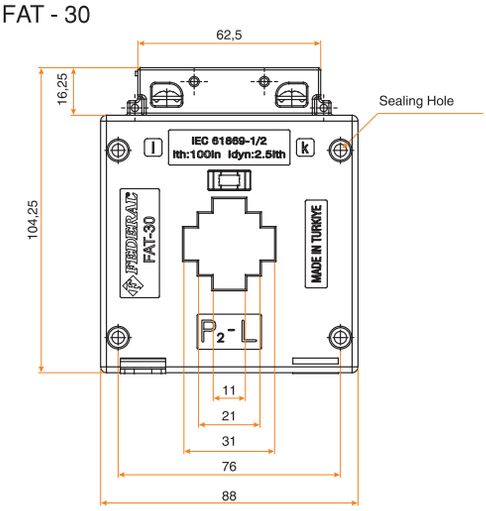
(*) Current transformers must always be operated in case of short circuit. If the primary winding is under voltage, the secondary winding should be kept in short circuit. Otherwise, a fatal risk may occur for individuals carrying out measurement due to the excessive voltage to occur in the secondary winding.

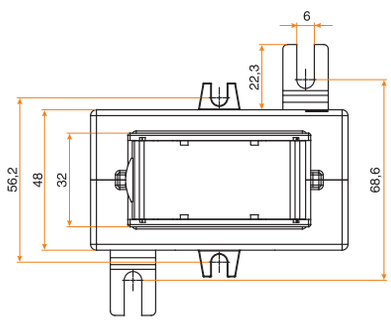
Proportion error in current transformers (as stated in the standards) guaranteed only between 100% and 120% of the nominal current. Error class might be 2-3 times more especially in currents below half of the nominal current. Attention should be paid to keep the load currents in application between (1-1,2) x In.



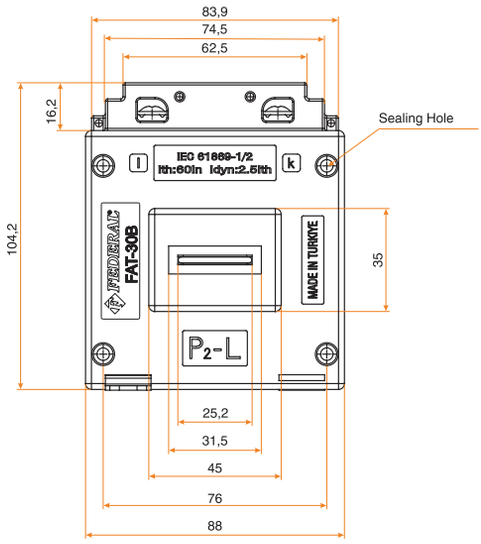
TYPE	Ct mounting method	Rated current (A)	Secondary Current (A)	Rated Power Class (VA)				Weight (kg)	Busbar (max) mm	Cable (max) mm	Rated short time thermal current (I_{th}) (1 sec.)	Rated continous thermal current (I_{cth})	Highest voltage for equipment (V)
				0,2s	0,2	0,5s	0,5						
FAT-30B	With Busbar	30 40 50 60 75 80 100 125 150 200 250	1A, 5A	- - - - - - - - - - 2,5	2,5 2,5 2,5 2,5 2,5 2,5 2,5 2,5 2,5 2,5 2,5	5 5 5 5 5 5 5 5 5 7,5 10	10 10 10 10 10 10 10 10 10 10 10	0,60	-	-	60xIn (1s)	1,2xI_n	720 V
FAT-30C	Without Busbar	150 200 250 300	1A, 5A	- - 2,5 2,5	- 2,5 2,5 5	2,5 5 10 10	5 10 10 10	0,63	30x10	Ø31	100xIn (1s)	1,2xI_n	720 V
FAT-30	Without Busbar	100 125 150 200 250 300	1A, 5A	- - - - 2,5 5	- - - 2,5 5 10	2,5 2,5 5 7,5 10 10	5 5 7,5 10 10 10	0,60	30x10	Ø24	100xIn (1s)	1,2xI_n	720 V
FAT-40	Without Busbar	100 125 150 200 250 300 400 500 600	1A, 5A	- - - - - - 2,5 5 7,5	- - - - - 2,5 5 10 10	- - 2,5 2,5 5 7,5 10 10 10	2,5 2,5 5 5 10 10 10 10 10	0,38	40x10	Ø33	50kA (1s)	1,2xI_n	720 V
FAT-40C	Without Busbar	200 250 300 400 500 600	1A, 5A	- - - 2,5 5 7,5	- - 2,5 5 10 10	2,5 5 7,5 10 10 10	5 10 10 10 10 10	0,38	40x10	Ø41	50kA (1s)	1,2xI_n	720 V
FAT-60	Without Busbar	400 500 600 750 800 1000 1200 1250	1A, 5A	- - - 2,5 5 7,5 10 10	- 2,5 2,5 7,5 7,5 10 10 10	2,5 7,5 10 10 10 10 10 10	5 10 10 10 10 10 10 10	0,60	60x20	Ø46	50kA (1s)	1,2xI_n	720 V
FAT-100	Without Busbar	1000 1200 1250 1500 1600 2000	1A, 5A	5 7,5 7,5 10 10 10	10 15 15 15 15 15	15 15 15 15 15 15	15 15 15 15 15 15	0,94	80x30 100x10	Ø62	50kA (1s)	1,2xI_n	720 V
FAT-130	Without Busbar	1500 1600 2000 2500 3000 3200 4000	1A, 5A	15 15 20 30 30 30 40	15 15 20 30 30 30 40	15 15 20 30 30 30 40	15 15 20 30 30 30 40	1,50	125x58	Ø125	50kA (1s)	1,2xI_n	720 V

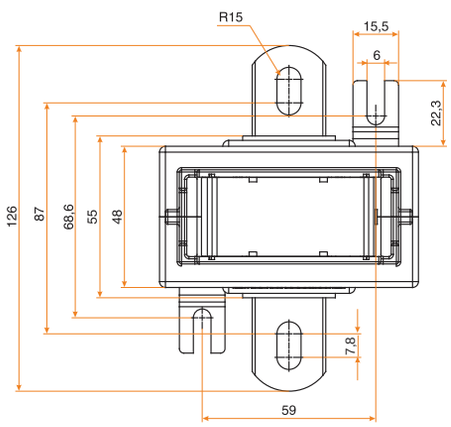
FAT - 30



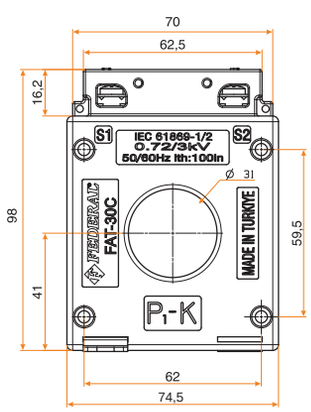


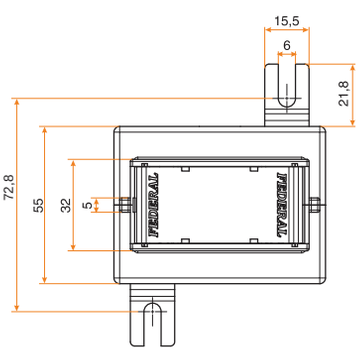
FAT - 30B



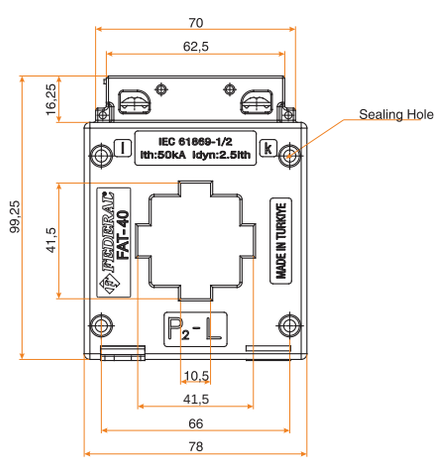


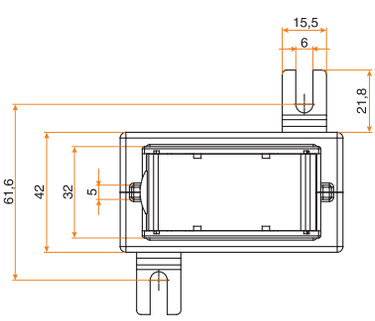
FAT - 30C



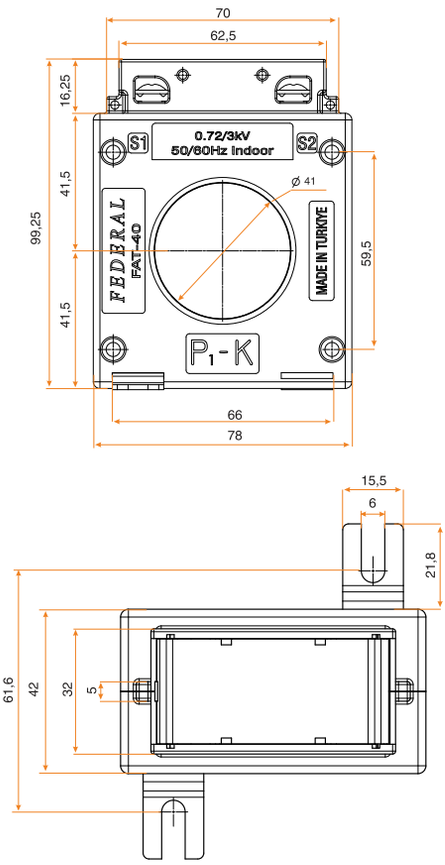


FAT - 40





FAT - 40C



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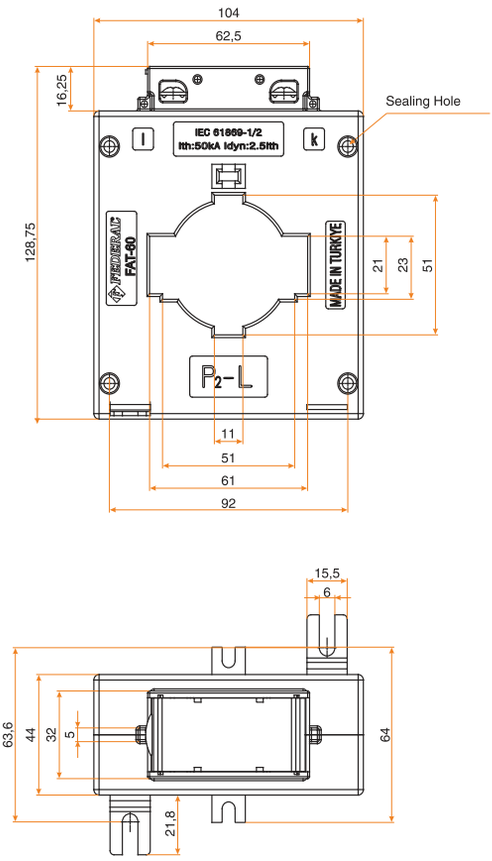
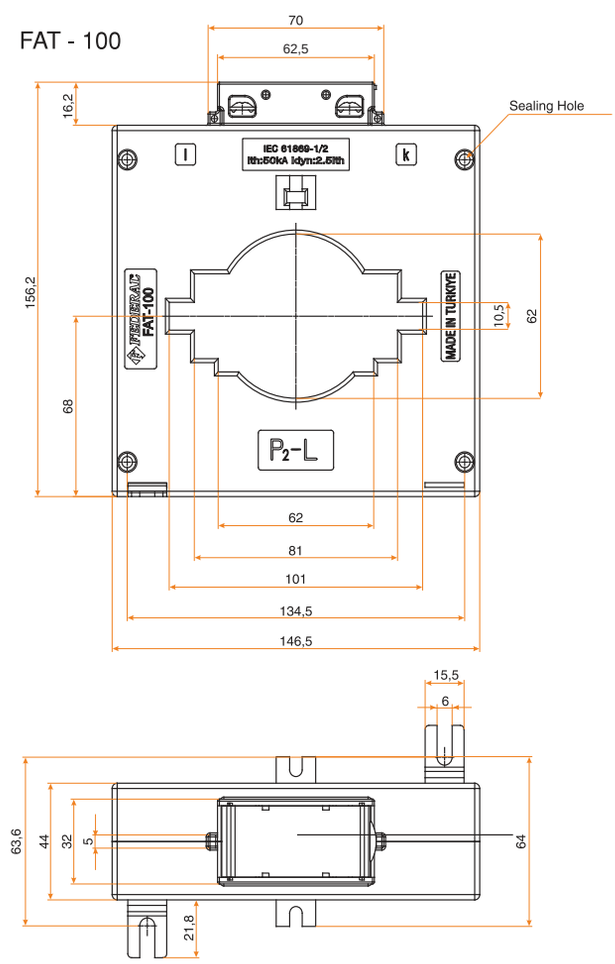


FAT - 100



FAT - 130