BRITISH STANDARD

BS EN 15431:2008

Winter and road service area maintenance equipments — Power system and related controls — Interchangeability and performance requirements

ICS 43.160

BSI British Standards

National foreword

This British Standard is the UK implementation of EN 15431:2008.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Winterdienst- und Straßenbetriebsdienstausstattung - Antrieb und Steuerung von Anbaumaschinen - Anforderungen an Austauschbarkeit und Leistung

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Foreword

This document (EN 15431: 2008) has been prepared by CEN/TC 337/WG 3 "Interface between tools and vehicle", the secretariat of which is held by UNI-CUNA, under the direction of Technical Committee CEN/TC 337 "Winter maintenance and road service area maintenance equipment", the secretariat of which is held by AFNOR.

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1 Scope

This document applies to power systems equipped for the operation and able to drive implements and attachments such as snow ploughs and/or spreaders on winter service vehicles or mowers on road service area maintenance vehicles, equipped with front-mounting plates according to EN 15432.

The purpose of this standard is to ensure interchangeability of vehicles and implements. The minimum requirements on the performance and the components of the hydraulic system as well as the kind, the size and the location of the connecting elements between the vehicle and the implement are specified in this standard.

This standard does not deal with airport equipment.

This standard does not cover applications, where the implements need a continuous hydraulic oil flow exceeding 45 l/min.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references the latest edition of the referenced document (including any amendments) applies.

ISO 1185, *Road vehicles – Connectors for the electrical connection of towing and towed vehicles – 7-pole connector type 24 N (normal) for vehicles with 24 V nominal supply voltage*

ISO 1724, *Road vehicles – Connectors for the electrical connection of towing and towed vehicles – 7-pole connector type 12 N (normal) for vehicles with 12 V nominal supply voltage*

ISO 16028, *Hydraulic fluid power – Flush-face type, quick-action couplings for use at pressures of 20 MPa (200 bar) to 31,5 MPa (315 bar) – Specifications*

ISO 16844-2, *Road vehicles – Tachograph systems – Part 2: Recording unit, electrical interface*

3 Power System and related controls

3.1 Hydraulic system for municipal vehicles - Specifications

3.1.1 Drive of the oil pump

The oil pump shall be driven directly by the vehicle engine and independently from the vehicle drive train. A clutch or a coupling between the engine and the pump is permissible. A drive ratio between the engine and the pump is allowed.

3.1.2 Hydraulic Circuits

The hydraulic circuits must be open type circuits.

The hydraulic system consists in either one variable displacement pump or one or two constant pumps.

If there are two circuits, they shall provide flowrate and pressure independent at any working condition.

For each circuit there shall exist:

- one primary excess pressure protection device and
- one switching device for unpressurized circulation. Each circuit or both circuits together shall be equipped with an oil reservoir and a filter for protection of the hydraulic system.

3.1.3 Connection between the hydraulic system of the vehicle and the implements

Hydraulic connectors shall be ensured by the use of quick couplings, refer to 3.1.10.

3.1.4 Flow Rates

Nominal Flow Rate circuit No. 1:	min. 20 l/min +/- 5 l/min at 75 % of the nominal engine speed (e.g. snow plough);
Nominal Flow Rate circuit No. 2:	min. 40 l/min +/- 5 l/min at 75 % of the nominal engine speed (e.g. spreader).

3.1.5 Pressure

Pressure circuit No.1:	min. 175 bar
Pressure circuit No.2:	min. 200 bar at trucks with GVW ≤ 18 t
	min. 250 bar at trucks with GVW > 18 t

3.1.6 Power

Minimum continuous power for both circuits: P_{min} = 16 kW at trucks with GVW ≤ 18 t

P_{min} = 20 kW at trucks with GVW > 18 t

3.1.7 Capacity of the oil tank

The capacity of the oil tank shall be such that a removal by the implements up to 10 l shall not affect the ability of the hydraulic system to work properly.

3.1.8 Maximum oil temperature, cooling capacity test procedure

The cooling capacity of the hydraulic system for winter maintenance vehicles shall be at least 5 % of the minimum continuous power (see section 3.1.6). For road service area maintenance vehicles including summer operation the cooling capacity shall be at least 25 % of the minimum continuous power. If required, an oil cooler can be installed.

The cooling capacity shall be verified with a test, which is described in the following.

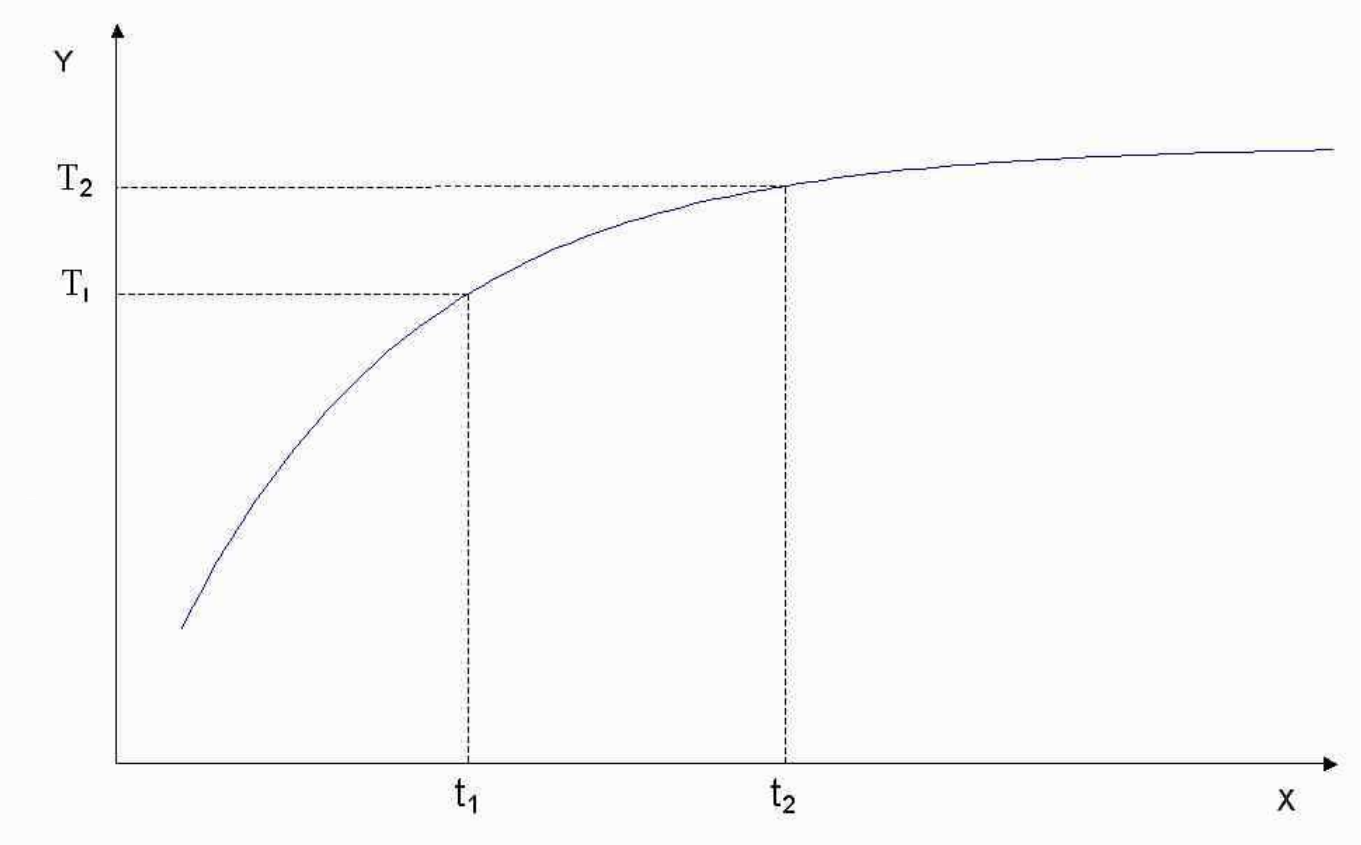
While executing the hydraulic system test in the hydraulic circuit 2, the difference between the hydraulic oil temperature in the oil tank and the ambient air temperature must not exceed ΔT = 50 K, i.e. with an ambient air temperature of 30 °C, the hydraulic oil temperature in the oil tank must not exceed 80 °C.

An adjustable restrictor for simulating the power loss shall be connected to the couplings of circuit 2. The restrictor should be adjusted to a value Δp, that gives a power absorption equivalent to 5 alternatively 25 % of the minimum continuous power at 75 % of the rated engine speed. During the test, a temperature difference between the hydraulic oil temperature in the oil tank and the ambient air temperature of ΔT = 50 K must not be exceeded.

The oil temperature has to be measured at the outlet of the oil tank.

For testing the system, the fans of the hydraulic oil cooler – if installed - need to be engaged.

Test condition: ambient air temperature 25 °C ± 10 °C.



Key

X t [s]
Y T [°C]

Figure1 – Temperature rise over time

Table 1 – Minimum cooling capacity

	Cooling capacity [% of the minimum continuous power]	Max. ΔT [K]
Winter maintenance vehicle	5	50
Road service area maintenance vehicle (winter and summer use)	25	50

The test can be terminated, when the temperature gradient $(T_2 – T_1) / (t_2 – t_1)$ is less than 5 K / 20 min.

$P = Q \times \Delta p$ (1)

where

P is the power according to the minimum continuous power (see section 3.1.6);

Q is the volume flow of circuit 2 at 75% of the rated engine speed (max. volume flow when variable displacement umps are being used);

Δp is the adjusted pressure at the flow restrictor;

T is the oil temperature at the outlet of the oil tank;

ΔT is the temperature difference between the hydraulic oil temperature in the oil tank and the ambient temperature;

t is the time.

EXAMPLE for calculating the Δp for the test, which has to be adjusted at the flow restrictor:

GVW of the truck e.g. 19 t ➔ P_{min} = 20 kW (3.1.6)

Rated engine speed e.g. 2 200 min^{-1} ➔ 75 % of rated engine speed = 1 650 min^{-1}

Cooling capacity 5 % (winter maintenance vehicle) ➔ 5 % of 20 kW = 1 kW

Cooling capacity 25 % (road service area maintenance vehicle) ➔ 25 % of 20 kW = 5 kW

Calculation of the pressure at the flow restrictor: $\Delta p = P/Q$

E.g. Q = 45 l/min, P = 1kW ➔ Δp = 13,33 bar

E.g. Q = 45 l/min, P = 5kW ➔ Δp = 66,67 bar

With this value of Δp, the test has to be executed.

3.1.9 Line cross sections

Circuit 1	min. internal diameter	10 mm
Circuit 2	min. internal diameter	12 mm
Separate Return Line via filter	min. internal diameter	18 mm
Un-pressurised Return Line	min. internal diameter	10 mm

3.1.10 Couplings and functions

3.1.10.1 General

Standard for a winterservice vehicle are 4 couplings at the front of the vehicle to control i.e. the snow plough and 2 couplings (continous flow) to drive i.e. the salt spreader.

3.1.10.2 Hydraulic circuit 1:

Table 2 – Couplings circuit 1

Circuit	Cell	Port	Symbol	Colour	Function	Size/Standard
	1	1	①	red	Implement lift	ISO 16028 size 12.5 (socket)
		2	②	red	Implement lower	
	2	3	③	green	Move to the left	
		4	④	green	Move to the right	
	3	5	⑤	yellow	Available for additional function	
		6	⑥	yellow		
	4	7	⑦	blue	Available for additional function	
		8	⑧	blue		
		T (Separate return line)		black	Discharge to tank via filter	ISO 16028 size 19 (socket)

3.1.10.3 Hydraulic circuit 2:

Table 3 – Couplings circuit 2

		P (Pressure line)		red	Continuous flow	ISO 16028 size 19 (plug)
		T (Separate return line)		black	Discharge to tank via filter	ISO 16028 size 19 (socket)
		Unpressurised return line	-	black	Discharge directly to tank	ISO 16028 size 10 (socket)

3.1.11 Hydraulic Fluid

The fill-in of the tank for the hydraulic fluid shall be marked with the type of fluid to be used.

3.2 Mechanical Front-Mounted Power Take Off PTO, shaft profile and Performance

3.2.1 General

Depending on the rated PTO-output the type of profile is to be used:

3.2.2 Profile A: n = 540 min^{-1} P_{max} = 60 kW

n = 1 000 min^{-1} P_{max} = 92 kW

3.2.3 Profile B: n = 540 min^{-1} or n = 1 000 min^{-1} P_{max} = 150 kW

3.2.4 Power take-off shaft profile

Dimensions in millimetres

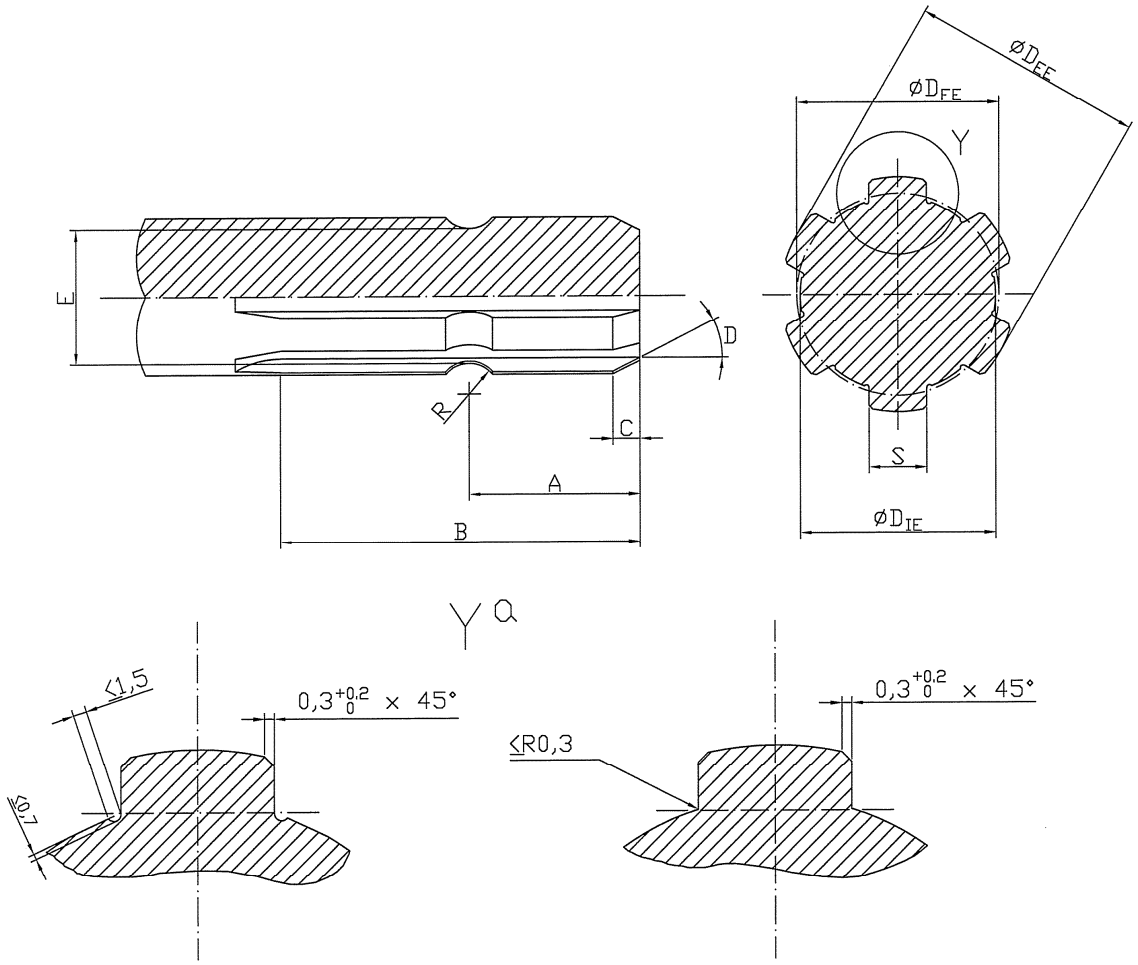


Figure 2 – PTO shaft

Table 4 – Dimensions PTO shafts

All dimensions in millimetres

Dimension	Symbol	Profile A based on ISO 500-3, Type 1	Profile B based on SAE J499a
Number of splines	*n*	6	6
Groove to end of shaft	*A*	38 ± 0,8	38 ± 0,3
Effective spline length and hardened portion	*B*	≥ 76	77
Chamfer	*C*	6 + 1	8,7 ± 0,2
Chamfer angle	*D*	30 ° ± 3 °	30 ° ± 5 °
Major diameter	D_{EE}	34,87 - 0,12	44,32 + 0,05
Form diameter	D_{FE}	≤ 30,0	-
Minor diameter	D_{IE}	29,0 ±0,1	36,0 + 0,25
ID of groove	*E*	29,40 ± 0,1	37,21 + 0,13
Radius of groove	*R*	6,8 ± 0,25	8,3 + 0,3
Tooth thickness	*S*	8,51 min / 8,64 max	10,95 + 0,05
Power take-off shaft profile		1 3/8”	1 3/4”

3.3 Electrical Connectors

3.3.1 Connector 24 V, 7 pins, at the front of the vehicle, socket design according to ISO 1185

Table 5 – Functions front connector 24V

Pin #	Circuit #	Colour	Function/ circuit
1	31	White	Ground (24 V-)
2	58-L	Black	Front left-side marker light
3	L	Yellow	Turn signal light, left
4	54	Red	Dipped beam headlights*
5	R	Green	Turn signal light, right
6	58-R	Brown	Front right-side marker lights
7	54-G	Blue	Headlights – main beam*
* Function only available at vehicles without bulb warning indicator.			

3.3.2 **Connector 12 V, 7 pins,** at the front of the vehicle, socket design based on ISO 1724

Table 6 – Functions front connector 12V

Pin #	Circuit #	Colour	Function/ circuit
1	L	Yellow	Turn signal light, left
2	54	Red	Dipped beam headlights*
3	31	White	Ground (12 V-)
4	R	Green	Turn signal light, right
5	58-R	Brown	Front right-side marker lights
6	54-G	Blue	Headlights – main beam*
7	58-L	Black	Front left-side marker light
* Function only available at vehicles without bulb warning indicator.			

3.3.3 Electrical Connectors in the cabine, 24 V, 3 pin

Socket 24V (male), max. amperage I = 15 A, Protection class IP54

Dimensions in millimetres

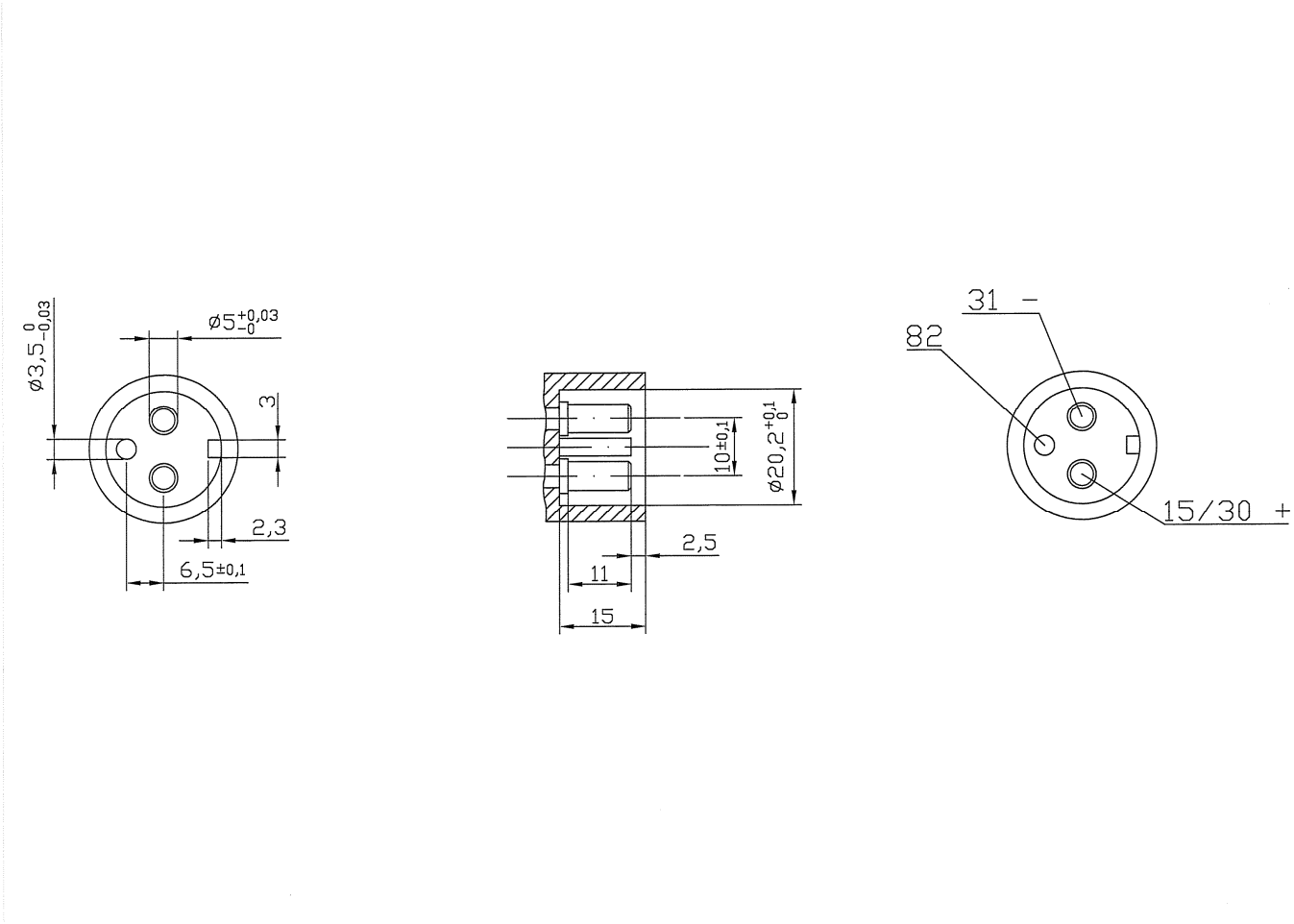


Figure 3– 24 V socket

Table 7 – 24 V socket

Pin	Function
82	Speed Signal
31 -	Ground (24V -)
15/30 +	Pos. (24V +)

The speed pulse output (Pin 82) is a pulse-gap modulated signal according to ISO 16844-2, connector contact number B7.

3.3.4 Electrical Connectors in the cabin, 12 V, 3 pin

Socket 12V (female), max. amperage I = 25 A, Protection class IP54

Dimensions in millimetres

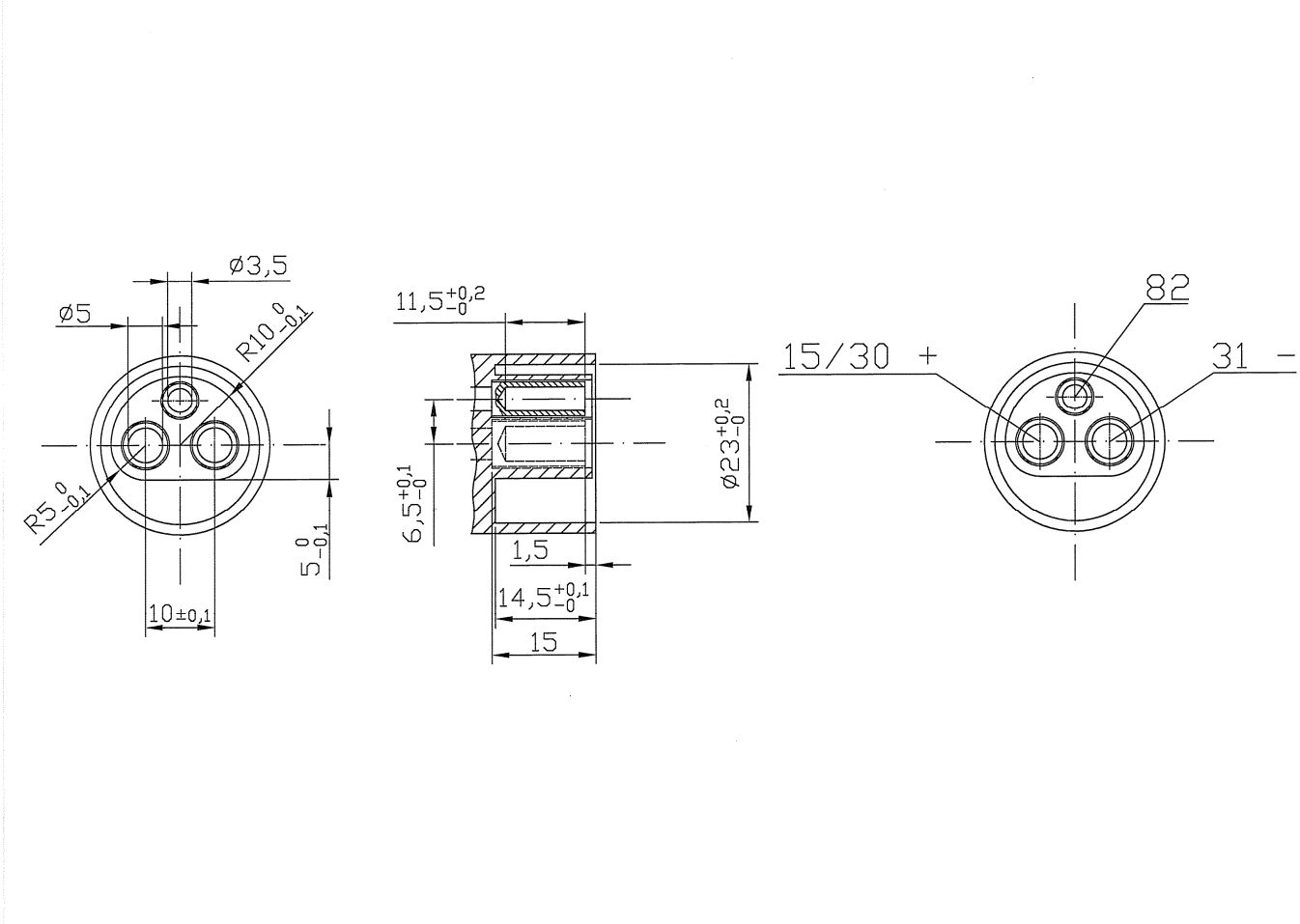


Figure 4 – 12 V socket

Table 8 – 12 V socket

Pin	Function
82	Speed Signal
31 -	Ground (12V -)
15/30 +	Pos. (12V +)

The speed pulse output (Pin 82) is a pulse-gap modulated signal according to ISO 16844–2, connector contact number B7.

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[4] SAE J 499a:1975, Parallel side splines for soft broached holes in fittings

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