



5.11 Electric installation

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Technical conditions for conducting electricity installations at ŠKODA AUTO.

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Note: In case of any differences between the Czech, English or German language mutation of this ITS, the Czech version takes precedence. The Czech version is available at <http://cts.skoda-auto.com/>.

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1.	1997-01-13	Page 1, 2
2.	2002-02-01	Arial font, ŠKODA AUTO logotype
3.	2010-12-21	fully revised
4.	2012-02-15	update norm (3.1, 6.2.1, 7.4.1)



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1 General requirements

1.1 The supplier must deliver the equipment and conduct electric installation in line with ČSN, in particular as regards protection of devices from dangerous touching, securing of machinery against overload and effects of shorted circuits.

2 Installation of earth connection

2.1 Laying of earth connections

2.1.1 It must be laid in order to establish good contact with the adjacent earth (stones and gravel impair transient resistance).

2.1.2 To increase the conductivity of earth no substances can be used which cause corrosion of material.

2.1.3 The distance of earth connectors from the foundations of buildings must be more than 2 metres.

2.1.4 The layer of earth into the depth of 50 cm must be regarded as ineffective for resistance outlet since freezing or drying out must be considered.

2.1.5 For band earth connections, if laid radiosymmetrically, the angle between neighbouring radials must not be less than 60 degrees.

2.1.6 Bar earth connectors are laid vertically if possible. When using a high number of earth connections, the distance between them should not be more than double the length of the bar.

2.1.7 Desk earth connection distance must be at least three metres.

2.1.8 Connections in the ground must be protected corrosion. Asphalt coating is recommended.

2.1.9 In places where there is the danger of mechanical damage band conductors in the ground are laid into tubes and on buildings into protective angle bars.

2.1.10 For the installation of angle bars the department of geodetic engineering in the plant must provide a detailed relevant extract plan of energetic distributions in the place of installation.

2.2 Accidental earth connections

2.2.1 Where possible, water pipes laid in the ground should be used as earth connection.

2.2.2 Extensive metal constructions touching the ground can be regarded as the main earth connection if its earth resistance is suitable.

2.2.3 When connecting earth connections of electric devices with a lightning conductor earth resistance must not exceed 2Ω .

2.2.4 When using grids as a link to earth connection one side of the angle bar must be visibly highlighted with green painting and yellow stripes.

3 Installation of lightning conductors

3.1 Installation of lightning conductors in keeping with ČSN EN 62305-1 ed. 2

3.1.1 After the installation has been finished inspection report must be drawn including a drawing and setting of inspection deadline in the location where the lightning conductor has been installed.

3.1.2 If possible, such manner of installation to avoid the necessity of disassembling the lightning conductor or at least decrease the range of disassembly.

3.1.3 When reconstructing lightning distributions in a storm season their permanent operation within the compound must be secured.



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3.1.4 Installation of earth connections as in 2.1.1.

4 Cable distributions

4.1 General remarks

4.1.1 When laying cables the air temperature must not drop under +5° Celsius. If a cable is stored outside in winter it must be left in a heated compound 24 hours before being laid to adopt to the temperature.

4.1.2 During storage and transport cables must be protected from humidity by plastic or asphalt fillers.

4.1.3 It is necessary to maintain drawing forces and bending radiuses as given in the instructions of cable manufacturers.

4.1.4 Entry into open channels and trenches must be secured by barriers, warning signs and red warning lights. The lightning must have maximum voltage of 24V.

4.1.5 Cross-over and simultanial arrangement of cables with other energetic distributions must be in keeping with ČSN 73 6005.

4.1.6 Cable and core isolation using a knife or stripping plils must be performed with caution as the isolation may be damaged ort he conductor may be broken.

4.2 Laying into trenches

4.2.1 Before digging is started the department of geodetic planning in the plant must provide a detailed excerpt from a plan of energetic distributions in the location where new cables or laid or current ones are repaired.

4.2.2 In the ground cables are laid in a sand bedding. To protect them from mechanical damage bricks or cement blocks are used. Warning red PVC foils are laid in keeping with ČSN 73 6006.

4.2.3 In the location under road cables are stored in protective tubes made of plastic, metal, cement or cement blocks. Sharp edges of the tubes of blocks are protected from mechanical damage using a soft undermat.

4.2.4 After the cables had been laid they must be measured again and incorporated into the geodetic plan.

4.3 Laying of cables into cable ducts accessible from above

4.3.1 Before the cables are laid ventilation of the ducts must be secured as well as its permeability.

4.3.2 Cables are usually laid on cable grids or brackets fastened by metal clamps and into cable boxings.

4.3.3 After the works have been finishshed the channels must be properly covered or necessary repairs of covering materials are conducted.

4.4 Laying into crawlways and passable channels

4.4.1 Laying as per 4.3.1 and 4.3.2.

4.4.2 Cables must be laid in a clear arrangement and it is particularly important to keep the distance between informing and signalling cables.

4.4.3 It is necessary to check whether the temperature in the channel does not exceed the limit which decreases the load of the cables.

4.4.4 During laying of new cables it is necessary to be cautious not to damage the current simultaneous cables.

4.5 Laying of cables in halls and other spaces

4.5.1 Cable laying in line with 4.3.2.

4.5.2 Fastening in line with 4.4.2.



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4.5.3 Placing of cable grids must be performed so as to prevent mechanical damage during manipulation, that is by a fork lift truck.

4.5.4 Attention must be paid to lead cables outside of sharp edges.

4.5.5 In workshops where melted materials or aggressive liquids are sprinkled cables must be protected with shields.

4.5.6 Cables are protected from mechanical damage by metal covers.

4.5.7 Cable grids are assembled in environments with corrosive effects (e.g. neutralizing station, charging station, etc.) It is necessary to provide them with acid resistant polishes.

4.6 Cables laid in steel-clad pipes

4.6.1 Cables laid in the floor must be lead in steel-clad pipes in their complete length. Hoses are not recommended.

4.6.2 Cables laid vertically and horizontally in steel-clad pipes must be properly fixed by clamps intended for this purpose or by means of steel bands welded to them.

4.6.3 Sharp edges of the steel-clad pipes are protected by rubber caps.

4.7 Laying of cables in channels of electric installation in offices, staircases and sanitary facility rooms

4.7.1 If power both conductor and communication cables are lead in a trench these must be divided by a partition wall.

4.8 Hanging cables

4.8.1 Hanging cables with a pressed in rope are used for outer conduct and in particular for transmission of outside communication through air.

4.8.2 Fastening ends of ropes must be painted and covered against corrosion and climatic conditions.

4.8.3 Considering the weight of cables of various cross-sections distances prescribed by the manufacturer must be maintained.

4.8.4 Cables hung on a rope using ESA clamps can only be used for necessary crossings inside compounds.

4.9 Distribution of cabling through flexible strings

4.9.1 Cable eyes according to 5.4.1 and 5.4.2.

4.9.2 Ends of autonomous conductors must not be plumbed and must be provided with pressed in ends /bushings/.

5 Connecting and ending of cables

5.1 Cable connections in the ground

5.1.1 Cast metal connection must have a firm undercover depending on its weight.

5.1.2 When connecting cables in bad weather conditions a shielding tent should be erected above the place of assembly as a protection against weather conditions that may affect the quality of the connection.

5.1.3 Casting material must have a proper temperature to cover the complete volume of the connection.

5.1.4 Ends of cables, lid and fastening bolts are also casted from outside.

5.1.5 For cables with smaller cross-sections neither Bakelite boxes nor similar connections.



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5.2 Cable connections in cables, halls, etc.

5.2.1 According to 5.1.1

5.2.2 Connecting cables where a connection cannot be used is performed using transition boxes at larger cross-sections and using water-resistant box distributors at larger cross-sections.

5.2.3 With smaller cross-sections conductors cannot be tweed using common isolation tape. Clamps in box distributors intended for this purpose must be used.

5.3 Endings

5.3.1 Cable endings are assembled in accordance with the assembly manual of the manufacturer.

5.3.2 Also endings made of casting (e.g. Eprosin).

5.4 Cable shoes and connecting tubes (connections)

5.4.1 Only cable eyes and connecting tubes are used which correspond with the cross-sections of individual wires.

5.4.2 Cable eyes and connecting tubes must be properly attached or pressed in. For conductor cross-sections exceeding 150 mm² it is necessary to perform dual attachment and for cross-sections exceeding 240mm² triple attachment or pressing in.

6 Installation of distribution facilities and electric stations

6.1 General

6.1.1 Assembly work at distribution facilities and in electric stations may be performed after consultation with respective technical department.

6.1.2 During the handover of electric station for operation, drawings and record of ground resistance measurement must be submitted by the supplier.

6.1.3 Inner distribution facility must be assembled only in rooms whose construction has been finished, i.e. with facade rendering and finishing of walls, which are also dry and clean.

6.1.4 Unused cable outlets are finished with end-seals.

6.1.5 Fastening to steel constructions can only be performed using screw connections.

6.1.6 Every distribution facility must undergo testing before operation run-up. Types of tests and manner of their conduct is prescribed by ČSN.

6.2 Grounding in electric stations

6.2.1 Requirements of grounding must adhere to ČSN EN 50522

6.3 Laying of cables

6.3.1 Stipulations given by section 4 must be adhered to.



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7 Installation of lighting and sockets

7.1 General

7.1.1 Breakdown switches, alteration switches or controlling switches should be always placed at entrances into compounds, especially in the case of orientation (walking) lighting.

7.1.2 Emergency lighting switches on automatically at the breakdown and therefore no other breakdown switches, alteration switches, etc. may not be inserted. Placing of lighting at important entrances.

7.1.3 Breakdown switches with signalization of control place are recommended for installation in dark corners.

7.1.4 In buildings where personnel is assigned to control the lighting, central control of the lighting can be arranged.

7.1.5 If automatic staircase switches are used for controlling the lighting of staircases and corridors, it must be possible to switch on the lighting permanently.

7.1.6 New lighting circuits of distributors labelled RS or RS are usually connected in halls.



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7.2 Installation of lighting

7.2.1 Lighting is installed so as to prevent damage by transport vehicles, cranes or other means and to secure entrance of maintenance personnel.

7.2.2 Covered lighting is selected so that the cover is secured against shaking.

7.2.3 In bulb lighting only bulbs with lower input power can be used if this does not influence prescribed intensity of lighting.

7.2.4 Lighting is installed in single and doubled rope hangers only in cases where firm cable grids cannot be used.

7.2.5 When attaching more pieces of lighting it is necessary to ensure balanced load of phases.

7.3 Public lighting

7.3.1 Lights of single and double light columns are installed according to installation instructions of the manufacturer.

7.3.2 Cable drenches, channels or ducts serve as a base for pipe connection for inlet charging cables.

7.3.3 Connection is established among steel columns and earth connection.

7.3.4 It is important that the secured cable box can be accessed through doors in a protective base.

7.3.5 Lights on buildings must be properly anchored to a steel board with screws.

7.4 Lighting at building sights

7.4.1 Lights are bolted to stable platforms or steel constructions. It is recommended to realize steel constructions so that the lights can be adjusted to various positions. Otherwise ČSN 34 1090 ed. 2 applies.

7.5 Socket installation

7.5.1 General

7.5.1.1 Sockets and other connectors are installed so as to avoid their flooding or filling with dirt.

7.5.1.2 Unchangeable sockets decided by the manufacturer must be used. Changes must be discussed with technical supervisor.

7.5.2 Socket boxes

7.5.2.1 Socket boxes are to be installed in such locations so that mobile connections attached to them are as short as possible.

8. Installations in spaces with danger of explosion and fire

8.1 General

8.1.1 Before starting the work installing workers must be alarmed about the possible danger arising during assembly in these special conditions.

8.1.2 Installation work in explosive environment can only be performed after consulting authorized technical department. Work under voltage is unacceptable.

8.1.3 Tools and devices emitting sparkles must not be used for work in explosive environments.

8.1.4 Welding is forbidden in these spaces. Bolted connections are preferred here for assemblies of cable grids and other steel constructions.



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9. Installation of machines and machinery facilities

9.1 General

9.1.1 Fastening metal parts, constructions, protective pipes, etc. must not be welded to any part of a machine, skeleton and other steel constructions. Only screw fixing is allowed.

9.1.2 No changes or adaptations of protective devices or removal of protective measures can be performed.

9.1.3 Unused cable outlets are to be sealed by blinding caps.

9.1.4 Rubber strings must not be used for conducts which are exposed to oils, fats or emulsions.

9.1.5 Connecting conductors must be permanently labelled.

9.1.6 Connection of individual machine and facility components that are otherwise unconnected mechanically must be using a protective conductor or band.

9.1.7 If shielded conducts are used, shielding must be incorporated into safety measures.

9.2 Placing and connection of control boxes

9.2.1 It is necessary to build the control cases so as to maintain a minimum passage clearance for maintenance between the individual cases. ČSN 333210 must be adhered to.

9.2.2 Only flexible conductors may be used for pop-up sets of switching cases. The conductors are bound together by suitable tapes.

9.2.3 Unused wires are connected either into clamps or are suitably fastened and isolated.

9.2.4 Cables and conducts must not be pressed to sharp edges.

9.2.5 With dust-resistant control cases cable and conduct inputs must be in accordance with the degree of covering.

9.3 Installation and engagement of switch controls

9.3.1 Switch cases may be fixed only through screws.

9.3.2 When placing the case it must be easily accessible.

9.3.3 Cable inputs should be lined with cable bushings.

9.3.4 Unused wires are to be connected into clamps or bonded together and isolated.

9.4 Installation and connection of fixed and mobile control panels

9.4.1 Process identical with section 9.3.

9.5 Placing and connection of cable boxes

9.5.1 Cable boxes must be installed in accessible locations.

9.5.2 Clamps to which lead-in voltage is connected should be protected with a cover with a safety sign.

9.5.3 Clamps to which foreign voltage is conducted should be labelled with warning signs.

9.5.4 Permanent signs are used for numbering and description of bars.

9.6 Installation of connecting conductors and cables.

9.6.1 To protect the conduct from mechanical damage it is to be laid in cable channels, protective pipes, etc.

9.6.2 Edges of sharp cable channels, protective pipes, etc. must be blunted to protect them from damage.



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9.6.3 Suitable size of passages for cables must be selected to allow for later addition of cables and possibly also exchange of faulty conduct.

9.6.4 Connection clips are used for fastening of protective pipes; to avoid damage to the individual conductors it is necessary to blunt all transitions and holes.

9.6.5 Conduct for set, power and signalling components must be long enough to allow adjustment of conductors during repairs.

9.7 Installation of threshold switches

9.7.1 Threshold switches are installed so that their easy replacement is allowed.

9.7.2 They are placed outside of reach of oils, cooling liquids and protected with caps. Caps must not disable checking of the threshold switch.

9.7.3 Threshold switches placed blind covers are to be labelled so that fiction signs are clearly visible even with caps on them.

10. Installation of welding machines and facilities.

10.1 General

Data given in section 9.1 applies also for installations of welding machines and machinery.

10.2 Laying, installation of cables and conduct

10.2.1 Process identical with sections 4 and 5

10.2.2 In places where cables or conduct may be damaged as a consequence of burning remains during welding or sparks, these must be protected with pipes or other covers.

10.2.3 When laying the individual conductors those that belong to the same stream circuit should be bound together and fastened.

10.2.4 Since backdraft occurs at every welding impulse, proper cable fastening must be paid attention to.

10.3 Installation and connection of control cases.

10.3.1 We proceed in the sense of section 9.2.

10.4 Installation and engagement of switch controls.

10.4.1 We proceed in the sense of section 9.3.

10.5 Installation and connection of fixed and mobile control panels

10.5.1 We proceed in the sense of section 9.4

10.6 Placing and connection of clamp boxes

10.6.1 We proceed in the sense of section 9.5

10.7 Installation of connecting conductors and cables

10.7.1 We proceed in the sense of section 9.6

10.8 Installation in the sense of threshold switches

10.8.1 We proceed in the sense of section 9.7

10.9 Installation and connection of control circuits of welding

10.9.1 Control circuits of welding are connected according to the manufacturer's instructions.



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11. Installation of communication facilities, facilities for data processing and safety facilities

11.1 General

11.1.2 We proceed in the sense of section I.

11.1.2 Apart from information given in section I the supplier must be interested in the arrangement of communication facilities, facilities for data processing and safety facilities.

11.2 Installation of earthing facilities

11.2.1 We proceed in the sense of section 2.

11.3 Installation of facilities protecting against lightning.

11.3.1 We proceed in the sense of section 3.

11.4 Laying of cables and conduct.

11.4.1 We proceed in the sense of section 4.

11.4.2 Conduct for communication facilities, facilities for data processing and safety facilities must be laid simultaneously with the conduct for energetic charging or control and welding conduct in cable baths, ladders or protective pipes.

11.4.3 Cable and circuit wire bushing must be marked. Marking must be clearly discernable and permanent. It must give information on the origin and intended target of the cable or circuit wire.

11.4.4 Length and position (location) of the cable and connective bushings as well as their parking must be handed over to respective technical department in the form of an inspection drawing or sketch. Measurement protocol of electric values such as loop and isolation resistance is handed to authorized technical department.

11.4.5 Cables and circuit wire of data processing facilities must be laid in separate cable trenches.

11.4.6 Cable baths must be marked.

11.4.7 Maximum length of shielded cables must not exceed 600 metres.

11.4.8 Coaxial cables must not be lengthened.

11.5 Connection of communication facilities, data processing facilities and security facilities.

11.5.1 We proceed in the sense of section 5.

11.5.2 Plumbing work performed to establish connection can only be done with electric soldering lamps with a separating transformer.

11.5.3 Before connecting a security facility (fire alarm, burglar alarm and room security alarm) it is necessary to inform the department running the facility (fire brigade, ...) of control tasks.

11.6 Run-up of the communication facilities, data processing facilities and security facilities.

11.6.1 Communication facilities are tested by the supplier before the run-up and handed over in an operational state to the authorized technical department.

11.6.2 Every telephone must be marked with its own number.

11.6.3 Facilities for data processing and security facilities may be measured and allowed for run-up by the manufacturer only.

11.6.4 When performing the operation run-up valid drawing documentation must be provided to the responsible technical department.



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11.6.5 After the installation has been finished this must be reported in writing to the supervising technical department.

11.6.6 The report on finishing the work must include evidence of the tests that have been conducted.

12. Uninstalling electric machines and facilities

12.1.1 Before starting the uninstallation of electric machines and facilities it must be properly secured that the uninstalled components are cut off the electric circuit.

12.1.2 In workplaces where the uninstallation is performed the supervising electricity maintaining unit must select and mark the distributions which will not be uninstalled and are under electric current.

12.1.3 Reusable material is placed to the storage of used material after consulting the technical department.

12.1.4 Material which cannot be used any further is sorted into metal, iron, cables and iron scrap and it is sent to the buyout.

12.1.5 If the mening caused by unistallation cannot be removed by the supplier, this must be reported to the department of construction immediately and necessary measures are taken.

12.1.6 Lose passages arising from uninstallation of cables must be sealed.

12.1.7 Cables which are expected for repeated use and are not uninstalled must be shorted out at the ends. Appropriate measures must be taken to secure them against switching on in the distribution case.

13. Function tests and operation run-up

13.1 Function tests

13.1.1 Perfect functioning of the komplete facility must be tested. Proper functioning of the complete electric equipment is tested both with and without load. In particular the perfect function of the emergency breakdown switch must be tested.

13.2 Handover and operation run-up

13.2.1 Handover is performed at the participation of the supplier and investor and ŠKODA AUTO employees. It is conducted in order to confirm operational technical parameters of electric facilities, completeness of the agreed delivery according to the contract and checking of realization according to ŠKODA AUTO ITS.

13.2.2 Handover process – final handover is performed only after all installation has finished and all electric facilities have run-up.

13.2.3 Complete documentation must be enclosed to every electric facility and must correspond to the achal realization. It must be in Czech including translation of the text in drawings.

13.2.4 With facilities intended for environments with a danger of explosion it is necessary that the manufacturer's attestation is confirmed by a state testing authority.

13.2.5 Should any defects arise during the handover which have not been agreed and approved in writing the delivering company is obligated to remove them free of charge.