NOKIA

DX 200

BSC3i S10.5

Installation Site Requirements for BSC and TCSM2

Site Documents

BSC3018_P

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Summary of changes

Changes between document issues are cumulative. Therefore, the latest document issue contains all changes made to previous issues.

Changes made between issue 5-0 and 6-0

Issue 6-0 for S10.5 release. Information on BSC3i added.

Changes made between issues 4-0 and 5-0

S10 update. Online modifications.

Changes for issue 4-0

Installation site lay-out figures updated and power distribution diagrams checked. Section *Requirements for DC power supply* upgraded.

1 Installation Site Requirements for BSC and TCSM2

Installation Site Requirements for BSC and TCSM2 provide basic installation site information needed for the installation planning of the BSC and TCSM2. These requirements do not, however, include the installation planning instructions for the station power supply equipment or for the PCM and alarm distribution frames.

1.1 Scope

The scope of this document is (please refer to section *Use of terms*):

- the BSC2A and TCSM2A
- the BSC2E and TCSM2E
- the High Capacity BSCi
- the High Capacity BSC2i
- the BSC3i.

1.2 How to use this manual

This manual provides the following information:

- dimensioning of the station power supply and power distribution
- environmental requirements
- ventilation and air conditioning
- equipment room layout
- cabling.

1.3 Use of terms

BSC (Base Station Controller) is a general term for all Nokia GSM/EDGE BSC versions. The BSC products are listed in the table below.

General name	Product name	Explanation
BSCE	BSCE	First generation Nokia DX 200 BSC
BSCi	BSCi	High Capacity (upgraded and improved) version of the first generation Nokia DX 200 BSC
BSC2	BSC2A	American National Standards Institute (ANSI) version of the second generation Nokia DX 200 BSC2
BSC2	BSC2E	European Telecommunications Standards Institute (ETSI) version of the second generation Nokia DX 200 BSC2
BSC2i	BSC2i, ANSI version	American National Standards Institute (ANSI) High Capacity version of the Nokia DX 200 BSC2
BSC2i	BSC2i, ETSI version	European Telecommunications Standards Institute (ETSI) High Capacity version of the Nokia DX 200 BSC2
TCSM2	TCSM2, ANSI version	American National Standards Institute (ANSI) version of the Nokia DX 200 Transcoder TCSM2
TCSM2	TCSM2, ETSI version	European Telecommunications Standards Institute (ETSI) version of the Nokia DX 200 Transcoder TCSM2
BSC3i	BSC3i, ANSI version	American National Standards Institute (ANSI) High Capacity version of the Nokia BSC3i
BSC3i	BSC3i, ETSI version	European Telecommunications Standards Institute (ETSI) High Capacity version of the Nokia BSC3i

Note

When the information in the text is only applicable to one of the versions or applications of the Base Station Controller, the name of that specific version or application is used; and when the text is applicable to all versions and applications, the general term BSC is used. When the information in the text is applicable to only one variant of the Base Station Controller or Transcoder, the name of that specific variant is used.

TCSM2 is the general term for the second generation Transcoder and Submultiplexer. TCSM2E stands for the ETSI (European) version and TCSM2A for an ANSI (US) version of the Transcoder. TCSM2A-C stands for the Transcoder-Converter variant of the ANSI version of the Transcoder.

The terms rack and cabinet are mutually interchangeable. 'Cabinet' refers to BSC3i, whereas 'rack' refers to all other BSC applications and TCSM2.

Note

The name TCSM2 is used in this document as a general term referring to any version of the second generation transcoder, TCSM2E, TCSM2A and TCSM2A-C.

1.4 Typographic conventions

The table below presents the conventions used in this manual.

Table 1. Typographic conventions.

Emphasized font	Indicates a reference to a manual, chapter or section, for example: See Chapter *Installation.* Indicates a word or phrase that is emphasized, for example: *The CPU.*

1.5 Your comments

We are always interested to know whether our manuals provide the information you need. If you have any comments about this document or any other Nokia manual, please pass them on to your local Nokia sales representative.

2 Power supply for BSC and TCSM2

This section describes the power supply system used in the BSC and TCSM2: the requirements for the station power supply, the power supply and distribution principles on the rack, cartridge and plug-in unit levels and the grounding principles of the BSC and TCSM2 station.

2.1 Station power supply for BSC and TCSM2

The power supply system used to power the DX 200 network elements is known as a floating battery system, in which the voltage (-48/-60 V_{DC}) is generated by rectifiers. Lead-acid batteries are used as a back-up energy source.

In the BSC and TCSM2, the voltage from the rectifiers or batteries is led through main fuses (normally in the rectifier system) and the internal power supply adapters (PSA20) and fuse panels (PSFP) of the racks to the DC/DC converters of the cartridges or plug-in units.

The BSC and TCSM2 racks are provided with two separate feeding input branches, each protected by fuses of its own. The two separate inputs make a redundant pair. In case the active lead (cable or circuit breaker) from the rectifiers/batteries fails, the redundant input will continue to supply power to the equipment.

Requirements for DC power supply

The supply voltage to the BSC and TCSM2 racks must meet the following requirements:

Voltage range	-40.5...-72 V	
Wideband noise	max. 240 mV_{RMS}	
Selective noise	20 Hz to 3 kHz	max. 200 mV_{RMS}
	3 kHz to 150 kHz	max. 45 mV_{RMS}
	150 kHz to 30 MHz	max. 10 mV_{RMS}

The figure below gives the permitted tolerances of overvoltage transients.

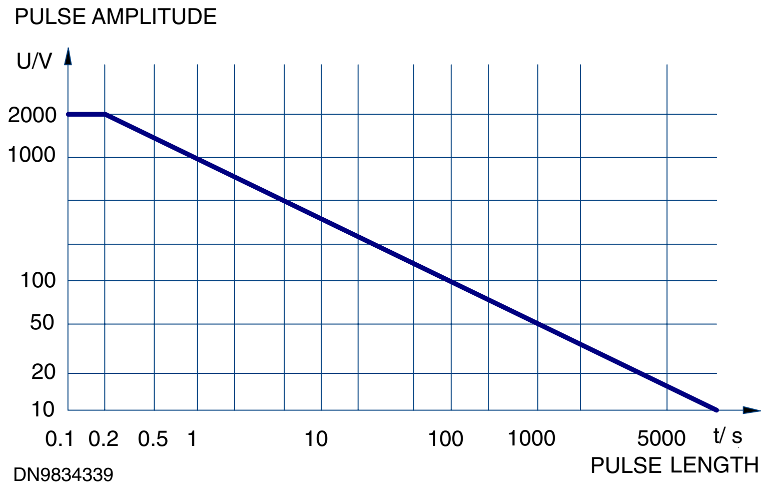


Figure 1. Maximum overvoltage transient measured at the connector block in the upper support structure of the rack

If the -48/-60 V DC power supply serves other equipment besides the DX 200, the maximum allowable break in the power-supply caused by the other equipment is 4 ms.

Batteries

The batteries are a back-up power source for the BSC and TCSM2 equipment in case the power supply from the rectifiers is interrupted. For ease and safety of battery maintenance, use of two or more separate battery groups is recommended. When dimensioning the battery system, note the following:

- To achieve a nominal voltage of -48/-60 V, a battery group may comprise 24 or 30 cells.
- The minimum allowed discharge voltage per battery cell is 1.80 V, which equals 43.2 V for a 24 cell battery set.
- If the voltage drop caused by the cables connecting the battery terminals to the DX 200 rack is higher than 1.5 V + 1.0 V at maximum discharge current, the minimum allowed discharge voltage per cell must be set higher accordingly.

The battery capacity should be selected according to backup time and load. The backup time depends on customer requirements. In designing the battery system, note that its capacity reduces somewhat as it ages.

The summed resistance of the battery, connectors and cables must be low enough in order to ensure that in case of a short circuit in one rack the power supply to the other racks will not be disturbed.

If the battery feeds other equipment besides the DX 200, the resistance of the battery and its cables must be as low as possible. This is to ensure that in case of a power supply failure, the disturbance does not spread from one system to another. Therefore, we recommend the use of additional capacitors in the power distribution busbar.

Dimensioning the power supply cables

Each BSC and TCSM2 rack requires two insulated, solid twin cables from the station power supply. The following factors must be considered when dimensioning the supply network:

- The cross section of the cables can vary from 16 mm^2 (AWG4) to 50 mm^2 (AWG1/0).
- The maximum lengths for various station supply cables are:
  - 25 meters for 16 m^2 (27.3 yds for AWG4)
  - 40 meters for 25 mm^2 (43.7 yds for AWG2)
  - 80 meters for 50 mm^2 (87.5 yds for AWG1/0).
- To minimize energy consumption, the supply cables should be dimensioned so that the voltage drop that they cause will be as small as possible. The maximum recommended voltage drop in the supply cables is:
  - 1.5 V between the main distribution bus and the terminal block of the DX 200 rack
  - 1.0 V between the batteries and the main distribution bus.

Note

The cables should meet the requirements of the UL 1459 standard and also the National Electrical Code ANSI/NFPA No.70. Strain relief is required before the cables can be connected to the rack.

Fuses protecting the supply cables

For the protection of each supply cable, a 32-63 / 70 A fuse is recommended, due to the use of 16 mm^2 (AWG4) wires in the rack power feed between the input connector (PSCG) and the circuit breakers (PSA20).

The table below shows the maximum combinations for various racks supplied through the 63/70 A fuses.

Table 2. Rack combinations.

Rack	Number of racks supplied by a cable pair (fuse 63/70 A)		
BCBE	2	1	0
BCEE	2	1	0
TC2E	0	1	2

When calculating how many racks one fuse is able to feed, the following values were used: 40 V as the voltage value and 0.7 V as a derating parameter for the fuse. The total load can be supplied through a single cable in case the other cable should fail. The power supply should have a capacity large enough to feed a fully equipped system.

Peripheral devices and AC power supply requirements

If peripheral devices (terminals or printers) are connected to the BSC and TCSM2 equipment, the required AC supply can be taken from either the mains supply or UPS (Uninterrupted Power Supply). The use of a redundant AC supply is recommended, since terminals and printers are indispensable in locating failures.

The typical power consumption values for peripheral devices are shown in the table below.

Table 3. Power consumption of peripheral devices.

Peripheral device	Power consumption
Printer	120 W
VDU	50 W

2.2 Power distribution to the BSC and TCSM2 racks

All voltages needed by the BSC and TCSM2 equipment are generated by DC/DC converters, located either in the racks, cartridges or plug-in units. They are operated on a nominal supply voltage of -48/-60 V.

Note

To avoid unnecessary alarms, the difference of voltage between two PSA20s must be within limits 0.8...2 V.

Power distribution on the rack level

The BSC and TCSM2 racks are provided with two feeding input branches, each consisting of one PSA20 unit (circuit breakers, diodes and filters) and one PSFP unit (fuses).

The power supply diagrams of the and BSC and TCSM2 racks are presented in the figures below. For further information, refer to Installing BSC and TCSM2.

Note

For simplicity, only the negative lead is drawn from the batteries to the cartridges.

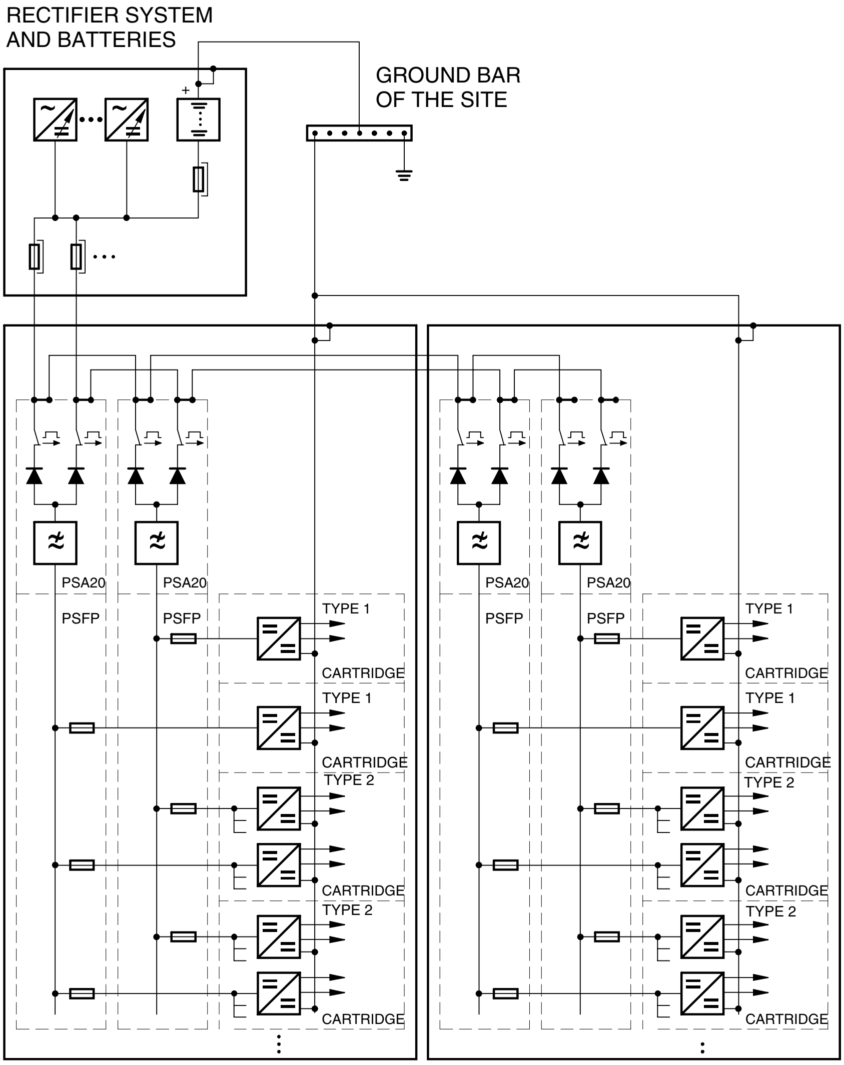


Figure 2. Power distribution diagram of the BSC

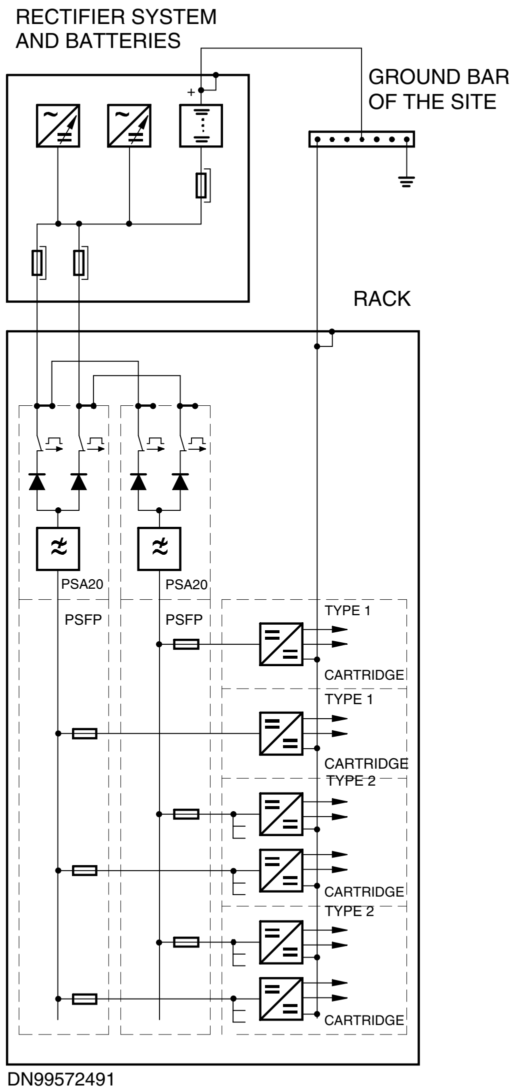


Figure 3. Power distribution diagram of the TCSM2

Power distribution on the rack level

Note

The BCEE extension rack of the BSC, if used, is fed from the BCBE rack.

On the rack, cartridge and plug-in unit level, the positive and negative inputs to the DC/DC converters must not be connected to the station ground. The power cables are only connected to the station ground at a single point, near the batteries

TCSM2 on a BSC site

When a TCSM2 is installed on a BSC site, the supply cables can be daisy-chained through all the BSC and TC2E racks.

Power consumption of the BSC

The power consumption values for the BSC2, BSC2i and BSCi racks are shown in the tables below. The figures are for maximum equipment configurations.

Table 4. Maximum consumptions for the BSC2 racks.

Rack type	Power Consumption
BCBE	515 W
BCEE	390 W

Table 5. Maximum consumptions for the BSC2i racks.

Rack type	Power Consumption
BCBE	730W
BCEE	770W

Table 6. Maximum consumptions for the BSCi racks.

Rack type	Power Consumption
BCBE	660 W
BCEE	620 W

For further information on the power consumption of the BSC, refer to Engineering for BSC.

Power consumption of DX 200 TCSM2

The maximum power consumption values for the TCSM2 applications are listed in the tables below. The figures are for fully equipped TC2E racks.

Table 7. Maximum consumption values for a normal TCSM2A application.

Operation mode	Consumption
Full rate only	312 W
Enhanced full rate only	472 W
Half rate only	740 W

Table 8. Maximum consumption values for a normal TCSM2A-C application.

Operation mode	Consumption
Full rate only	312 W
Enhanced full rate only	472 W
Half rate only	660 W

Table 9. Maximum consumption values for a TCSM2A-C application equipped with TR16-S plug-in units.

Operation mode	Consumption
Full rate only	392 W
Enhanced full rate only	592 W
Half rate only	860 W

Table 10. Maximum consumptions cartridges for a normal TCSM2E application.

Operation mode	Consumption
Full rate only	392 W
Enhanced full rate only	592 W
Half rate only	940 W

For further information on the power consumption of the cartridges used in the TCSM2, refer to Engineering for TCSM2.

2.3 Power distribution to the BSC3i cabinet (BSCC)

The BSC3i network element consists of one cabinet, the BSCC. The estimated maximum power consumption of a fully equipped BSC3i cabinet is 1805 W.

To ensure 2n redundancy for the power distribution lines, the BSC3i cabinet is provided with four PDFU-A units. Each PDFU-A forms an independent feeding input branches consisting of circuit breakers, diodes, filters and fuses. The feed cables to the cabinets must be also duplicated, with both supply lines connecting to both PDFU-A pairs (0 and 1; 2 and 3) in the cabinet.

On cabinet level, the operating voltages are to be fed to functional units backing each other up through separate distribution lines, following the principles listed below and illustrated in the figures which follow:

- In some cartridges, each plug-in unit makes up a functional entity of its own. These cartridges do not have any power supply plug-in unit. Instead, the plug-in units are equipped with onboard DC/DC converters, and one half of the cartridge is fed by one PDFU while the other half is fed by the other. In the figures that follow, these types of cartridges are referred to as 'type 1' cartridges and they include the ET4C-B and CLOC-B cartridges.
- The other cartridges are each equipped with one power supply plug-in unit, which feeds the other equipment in the cartridge. The redundancy of the power feed is achieved by supplying functional units backing each other up through separate PDFUs. In the figures that follow, these types of cartridges are referred to as 'type 2' cartridges.

The power supply diagram of the BSC3i cabinet is presented in the figure below.

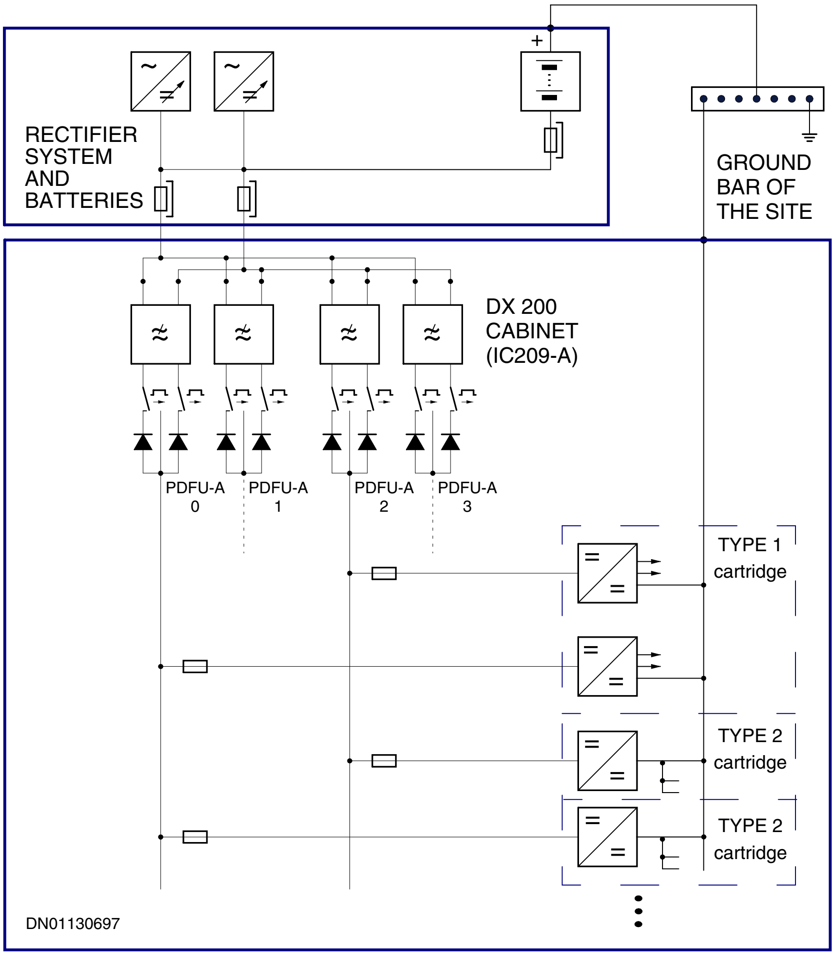


Figure 4. Power distribution diagram of the BSC3i

Note

For simplicity, only the negative lead is drawn from the rectifiers to the cartridges.

The four PDFU-As in the BSC3i cabinet are fed in pairs with supply cables of their own (for simplicity, only negative leads have been drawn from the rectifiers/batteries). For more information about the power supply to the BSC3i cabinet, see the figure below.

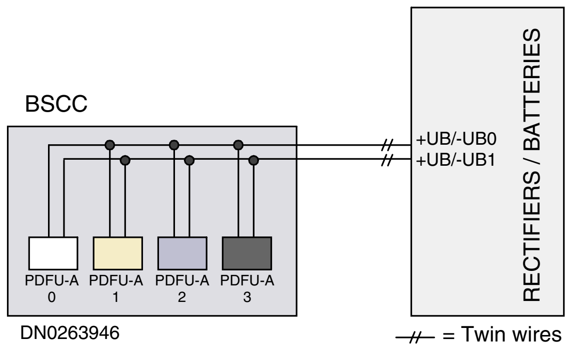


Figure 5. Power supply to the BSC3i cabinet using individual cables for each cabinet

The BSC3i cabinet is equipped with four Fan Trays, FTRB, each of which contains three fans. Each FTRB is powered by a separate PDFU-A. The fans are n+1/L redundant, meaning that if one of them fails, the remaining 11 fans automatically start to operate at maximum speed, which is enough to provide sufficient cooling.

For power supply from the rectifiers, the BSC3i cabinet always has cables of its own.

2.4 Grounding (earthing) of the BSC and TCSM2

The grounding (earthing) of the BSC/TCSM2 station must be carried out by strictly following the instructions given in the sections below, to ensure that in case of a failure (e.g. ground fault, climatic overvoltages), potential differences harmful to the equipment will not occur. Note also that the design of the station grounding must conform to any local regulations.

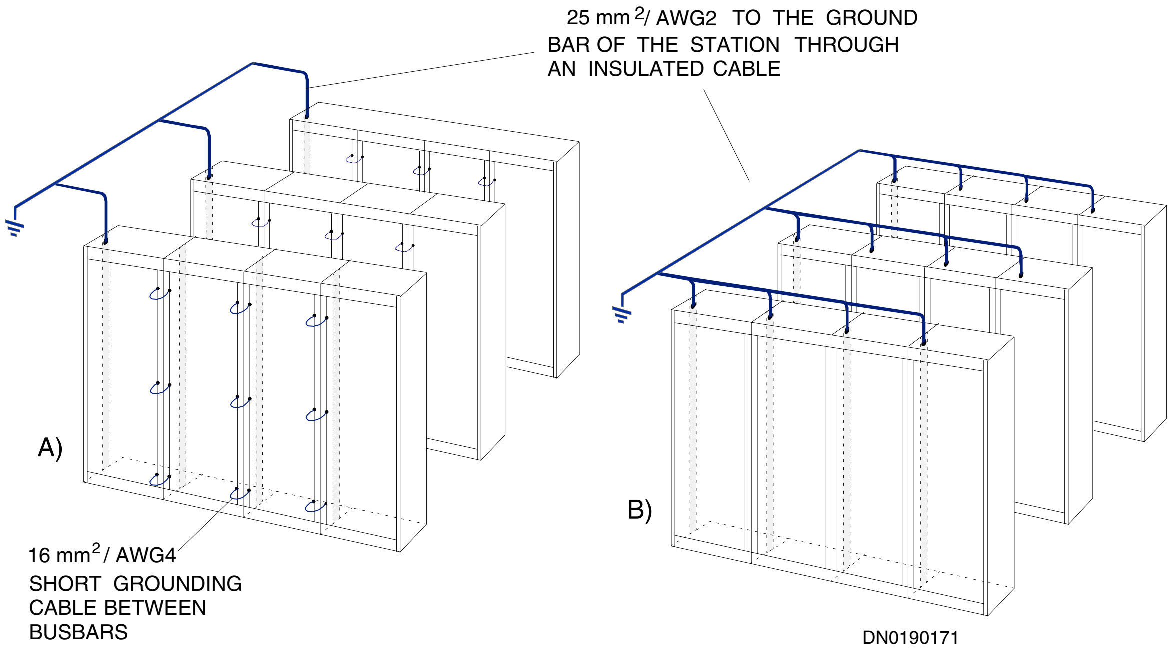
Grounding of the BSC/TCSM2 racks

In each cartridge, the 0-poles of the plug-in unit DC/DC converter outputs are connected to the back plane ground level, which in turn is galvanically connected to the cartridge side flanges. The potentials of the both power supply inputs to the cartridges are floating.

Inside the racks, the ground potentials of the cartridges are connected to a vertical copper busbar. The busbars of adjacent racks in the same row must be connected to one another at several points using short 16 mm^2 (AWG4) copper cables.

The grounding of the rack row is accomplished by using a 25 mm^2 (AWG2) cable, connected at one end to the first rack of the row, and from the other to the ground bar of the station (see the figure below).

If TCSM2/BSC racks are installed in the same room with the equipment of the network element which have a tree-like grounding level, e.g. DX 200 Mobile Switching Center, the grounding cable of a TCSM2/BSC2 rack row can alternatively be connected to this grounding level.



Here the racks are seen from the rear side, with the doors of the nearest rack row removed, to show the inter-rack grounding inside the racks. A = recommended way to ground.

Figure 6. Grounding of the BSC/TCSM2 racks

Note

To ensure the proper operation of the system, its frame structure must be grounded only to the grounding busbar of the equipment room, at a single point. At all other points, galvanic connection to the network element must be isolated from any conductive structures of the building in which the network element situated.

Grounding of the station power supply

The positive terminals of the central power supply must be connected to ground bar of the station using separate wires. The enclosure of the central power supply must also be separately wired to the ground bar.

Note

The positive leads of the power supply may not, under any circumstances, be connected to the grounding level of the racks!

The grounding (earthing) principle of a BSC/TCSM2 station is presented in the figure below.

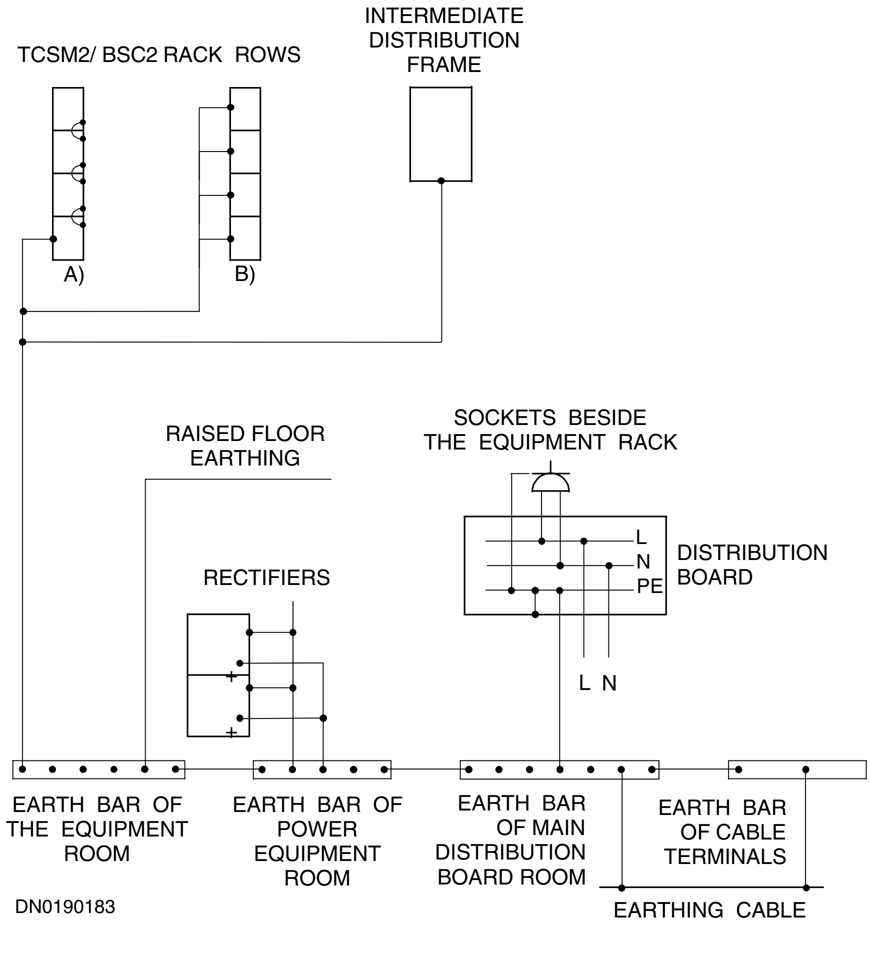


Figure 7. Grounding (earthing) principle of a BSC/TCSM2 station

2.5 Grounding (earthing) of the BSC3i

In the cabinets, the ground potentials of the cartridges and the 0–terminals of the DC/DC converters are connected to a vertical grounding busbar (as shown in 6alternative B in the grounding figures in Section *Grounding (earthing) of the BSC and TCSM2*).

An insulated copper cable between the BSC3i cabinets and the ground bar of the site finally connects the exchange to the station ground. The connector in the cabinets accepts a cable which has a cross sectional area of up to 35 mm^2 (AWG4); 25 mm^2 (AWG4) is the minimum size.

Note

The main grounding cables are not included in the DX 200 delivery.

The BSC3i network elements are designed to be compatible for installation in Mesh-IBN, Star-IBN or Mesh-BN according to ITU-T K.27 and Mesh-CBN according to ETS 3000 253. Per each type of BN, appropriate grounding practices shall be followed.

CBN	Common Bonding Network
IBN	Isolated Bonding Network
BN	Bonding Network

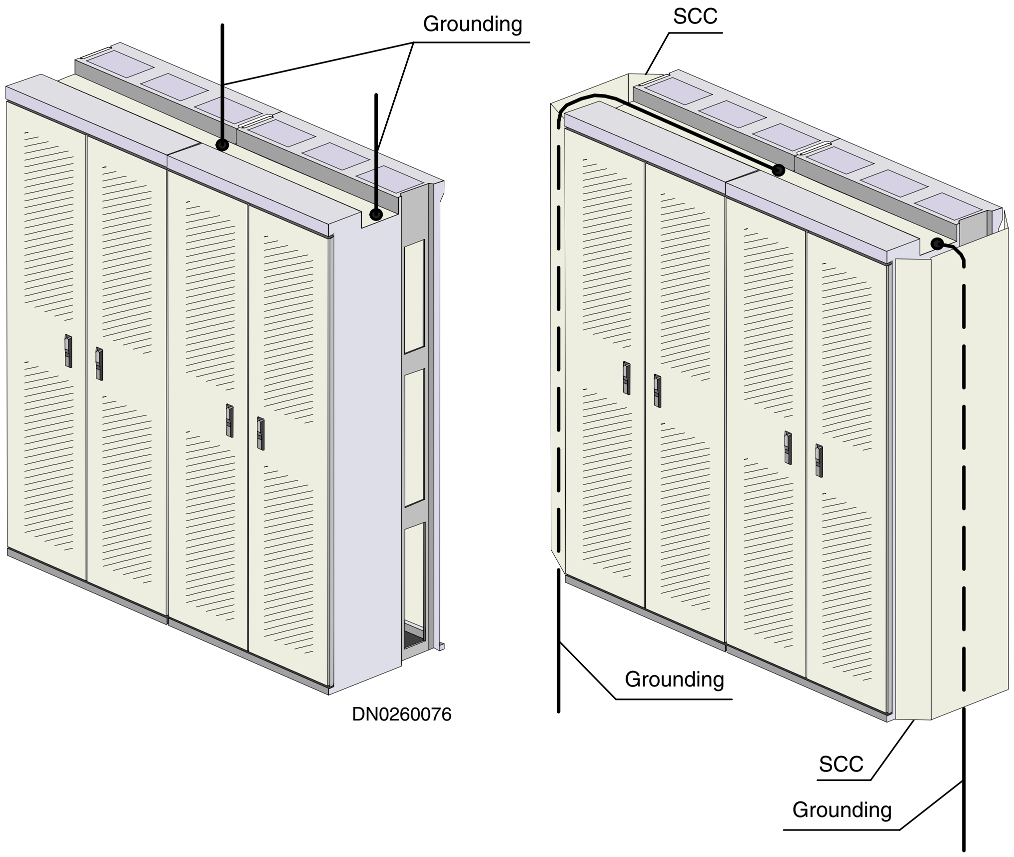


Figure 8. Grounding level of the BSC3i network elements

Note

The BSC3i network element consists of one BSCC cabinet

The station must be grounded according to the existing local regulations. In the grounding arrangements, please note the following:

- Galvanic connection between the grounding level and the steel construction of the building must be established only through the grounding cables.
- The positive conductors of the power supply must only be connected to the ground bar at the rectifiers' end.
- The frame structure of the exchange, which is connected to the grounding level, must be isolated from its surroundings and from the protective earth (PE) of the AC mains network.

These grounding arrangements will ensure that in case of a failure (ground fault, climatic overvoltages), voltage differences harmful to the equipment will not occur. For the grounding principle, see 7Grounding (earthing) principle of a BSC/TCSM2 station.

3 Environmental requirements for the BSC and TCSM2

This section describes the environmental requirements and recommendations for the BSC and TCSM2 network elements, and lists the international standards the equipment complies with.

The BSC and TCSM2 network elements are tested to comply with the ETSI standards ETS 300 019-1-1, ETS 300 019-1-2 and ETS 300 019-1-3, as specified in the tables below.

Table 11. ETSI standards defining the environmental requirements for the BSC and TCSM2 network elements.

Conditions		Standard	Class
Normal operation	Mechanical conditions	ETS 300 019-1-3	3.2
	Other conditions[1]	ETS 300 019-1-3	3.1 E
Transportation [2]		ETS 300 019-1-2	2.3
Storage	Chemically active substances[2], mechanically active substances and mechanical conditions	ETS 300 019-1-1	1.3 E
	Other conditions	ETS 300 019-1-1	1.2

[1] contrary to ETS 300 019- 1-3, Class 3.1E, power-up not allowed below 0° C

[2] contrary to ETS 300 019- 1-2, Class 2.2, no toppling around the edges allowed; rolling or pitching allowed at an angle of up to +/-35° for a period of 8 seconds (angles up to 22,5° can be reached for long periods of time).

The ETSI standards defining the environmental conditions are based on corresponding IEC standards, which are listed in the table below.

Table 12. IEC standards defining the environmental requirements for the BSC and TCSM2 network elements.

Conditions		Standard	Class
Normal Operation	Climatic conditions[1)]	IEC 60721-3-3	K3
	Special climatic conditions	IEC 60721-3-3	Z2, Z4
	Biological conditions	IEC 60721-3-3	B1
	Chemically activesubstances	IEC 60721-3-3	C2 (C1)
	Mechanically active substances	IEC 60721-3-3	S2
	Mechanical conditions	IEC 60721-3-3	M1
	Earthquake resistance	IEC 60721-2-6	4)
Transportation	Climatic conditions[2)]	IEC 60721-3-2	K3
	Biological conditions	IEC 60721-3-2	B2
	Chemically active substances	IEC 60721-3-2	C2
	Mechanically active substances	IEC 60721-3-2	S2
	Mechanical conditions [3)]	IEC 60721-3-2	M1
Storage	Climatic conditions	IEC 60721-3-1	K3
	Special climatic conditions	IEC 60721-3-1	Z2
	Biological conditions	IEC 60721-3-1	B1
	Chemically active substances	IEC 60721-3-1	C2
	Mechanically active substances	IEC 60721-3-1	S3
	Mechanical conditions	IEC 60721-3-1	M3 (M4)

[1)] contrary to IEC 60721-3-3K3, power-up not allowed below 0° C.

[2)] contrary to IEC 60721-3-2K3, minimum temperature of -50° C approved (instead of the -25° C stated in the standard).

[3)] contrary to IEC 60721-3-2M1, no toppling around the edges allowed; rolling or pitching allowed at an angle of up to +/-35° for a period of 8 seconds (angles up to 22,5° can be reached for long periods of time).

[4)] applies to BSC2(i) and TCSM2 when NEBS Upgrade Kit has been installed.

NEBS stands for Network Equipment Building System. It is a set of Bellcore Standards, the purpose of which is to unify HW requirements and help Telephone companies to evaluate the suitability of products for use in their networks. Compliance to NEBS is usually required by RBOCs (Regional Bell Operator Company).

The BSC3i Network Element Hardware is NEBS Level 3 compliant, covering GR-63-CORE (1995) and GR-1089-CORE (1999) standards in Central Office or on equivalent premises, as applicable for Type 2 equipment specified in appendix B of GR-1089-CORE (1999).

The BSC2(i) and TCSM2 network element hardware is NEBS Level 3 compliant when the NEBS Upgrade Kit has been installed.

The following sections provide the key parameters for the environmental conditions during normal operation, transportation and storage, as stated in the standards above.

3.1 Operation

Climatic conditions

The BSC and TCSM2 network elements are designed to operate in temperature-controlled, weather-protected conditions. The climatic conditions required during normal operation are shown in the table below. More detailed information is provided in section *Temperature and air flow requirements in the exchange rooms.*

Table 13. Limits for temperature and humidity during operation.

Operation temperature:	-5 to +45°C (nominal +23°C)
	+23 to +113°F (nominal +73°F)
Change rate of temperature:	≤ 0.5°C/min (nominal 0.1°C/min)
	≤ 0.9°F/min (nominal 0.2°F/min)
Relative humidity:	5 to 90 % (nominal 50 %).

The limits of temperature and humidity should be taken as statistical fractional values which most likely will not be exceeded.

Note

For the BSC and TCSM2 network elements, power-up is not allowed below 0°C.

Mechanical conditions

The mechanical conditions required during operation are shown in the table below.

Table 14. Mechanical conditions required during operation.

Vibration:	- amplitude	1.5 mm (0.06 in), f = 2 to 9 Hz;
	- acceleration	5 m/s^2 (16.4 ft/s^2), f = 9 to 200 Hz
Impact:		40 m/s^2 (44 yd/s), 22 ms.

3.2 Transportation and storage

Climatic conditions

The equipment must be transported and stored in its own container. Some temperature recommendations are given in the table below.

Table 15. Limits for temperature during transportation.

	Celsius		Fahrenheit	
	min.	**max.**	**min.**	**max.**
Transportation:	-50°C	+70°C	-13°F	+158°F
Storage:	-5°C	+45°C	+23°F	+113°F
Long-term storage:	+15°C	+30°C	+59°F	+86°F

Relative humidity during transportation and storage may vary between 5 and 95%. During long-term storage, humidity between 20 and 75% is recommended.

Minimum air pressure during transportation is 70 kPa (which corresponds to an altitude of 3000 m or 9800 ft).

Mechanical conditions

The required mechanical conditions during transportation are shown in the table below.

Table 16. Mechanical conditions required during transportation.

Vibration:	- amplitude	3.5 mm (0.14 in), f = 2 to 9 Hz;
	- acceleration	10 m/s^2 (33 ft/s^2), f = 9 to 200 Hz
		15 m/s^2 (49 ft/s^2), f = 200 to 500 Hz
Impact:		300 m/s^2 (328 yd/s^2), 6 ms.

3.3 Dust

The equipment has been designed for use in an urban industrial area where the maximum annual average of dust concentration is 200 µg/m^3 (total suspended particles). The equipment is protected against the known harmful effects of dust by using, for example, encapsulated relays. However, the physical and chemical properties of dust in the environment vary and may cause problems which are not always perceptible. Therefore, the exchange rooms must be kept clean and appropriate instructions must be followed to ensure operational reliability and maximum life span of the equipment.

Air filtering

If the environment contains large amounts of active dust particles, the use of air filters is recommended. Adequate filtering in the equipment rooms is generally achieved with filters that trap 40 to 70% of the dust particles or whose weight separating capacity is ≥ 90%. The use of electrical or oil filters must be avoided. The filters must be cleaned regularly.

3.4 Chemical impurities

The BSC and TCSM2 network elements are designed to withstand impurities in quantities found in the air in a normal urban, industrial area.

3.5 Electrical environment

Electromagnetic compatibility (EMC)

The BSC and TCSM2 network elements are compliant with the EMC directive 89/336/EEC, and they are tested to meet the requirements of EN 300 386-2 (harmonized product family standard). They are also tested to meet the requirements set in FCC Rules CFR 47, Part 15, Subpart B, Radio Frequency Devices, 2001. The exchanges are designed to withstand electromagnetic interference occurring in a normal industrial environment. The emission of electromagnetic interference does not exceed the corresponding limits.

BSC and TCSM2 network element cabinet rows make up independent EMC-shielded units. The cabinet doors and the steel-sheet covers at the ends of the cabinet rows form the shielding.

Each BSC3i cabinet makes up an independent EMC-shielded unit.

Note

The EMC shield works only when the cabinet doors are closed.

Electrostatic discharge (ESD)

When the doors of all cabinets are closed, the equipment meets the appropriate requirements for electrostatic discharge under normal operation.

Caution

When the exchange is being installed or serviced, electrostatic discharge may cause interference or damage the equipment unless appropriate precautions are taken. Use antistatic materials on the floor and tables of the premises. During installation or service operations, use ground electrodes or corresponding antistatic devices.

Use of photographic flash

The light of a flash may penetrate the protective covers of EPROM circuits and disturb their functioning. For this reason, an exchange in operation should not be photographed using a flash.

4 Ventilation in the equipment rooms

This section describes the requirements and recommendations for the ventilation system in the exchange rooms.

4.1 Temperature and air flow requirements in the exchange rooms

The minimum and maximum operation temperatures for the BSC and TCSM2 equipment are -5 and +45°C (+23 and +113°F) respectively. For safety reasons, however, the exchange room layout and the ventilation system used should be designed so that the temperature in the premises stays between +10 and +35°C (+50 and +95°F), unless peripheral and measuring devices are used which require adherence to even stricter limits.

For the personnel working in the premises, the optimal inside temperature is +23°C (+73°F). In premises which are constantly occupied, the following values are recommended:

- nominal temperature +23°C (+73°F); variation between +18 and +27°C (+64 and +80°F) allowed.
- maximum temperature +27°C (+80°F), may be exceeded for 10 days per year
- maximum air velocity 0.5 m/s (20 in/s), at +27°C (+80°F).

Adherence to the above air velocity limit is required in the constant occupancy zone and in the area occupied by the exchange cabinets, to ensure that the personnel is not exposed to draft, and that the natural convection of the cabinets is not disturbed.

The ventilation system used must guarantee a sufficient amount of fresh air in the premises in accordance with local regulations.

4.2 Cooling methods available

In order to keep the temperature in the exchange rooms suitable for the equipment and personnel, heat must be usually reduced during warm seasons by means of ventilation or air-conditioning. Four different methods exist for achieving sufficient ventilation in the exchange rooms:

- natural ventilation
- forced ventilation
- air conditioning.

Ventilation arrangements based on the above methods or combinations of those methods are described in the following sections. The numerical values given are based on the assumption that the rise of room temperature is at a constant level of t = 5°C (t = 9°F).

4.2.1 Natural ventilation

If the thermal power to be removed per floor area (power density) is less than 50 W/m^2 (4.5 W/sq.ft.) and replacement air does not require filtering, adequate cooling can be achieved through natural ventilation. The building layout, the air inlets and outlets, as well as the ventilation ducts must be designed so that the inside temperature does not exceed +40 °C (+104°F) at the height of 1.5 m (5 ft) and at 0.5 m (20 in) distance from the racks. The outlet must be located higher than the upper part of the racks.

4.2.2 Forced ventilation

Forced ventilation is necessary when the power density exceeds 50 W/m^2 (4.5 W/ft^2). The most economical method is to use uncooled outside air. When uncooled incoming air is blown directly into an area which is constantly occupied, the power density must be below 100 W/m^2 (9 W/ft^2), to ensure that the temperature and airflow rate are satisfactory for people. If incoming air blows through the racks, the maximum power density is approx. 500 W/m^2 (45 W/ft^2).

If the power density exceeds 100 W/m^2 (9 W/sqf) but stays below 500 W/m^2 (45 W/sqf), adequate cooling can be achieved by letting fresh, cool air directly through the cabinets from below. The air velocity of the incoming air may not exceed 0.5 m/s (for more details, see below).

The heat release of DX 200 equipment may exceed NEBS GR-63-CORE, 04-12 heat release limits. Take this into account if planning a NEBS-compliant site.

Fresh air fan

Incoming air is blown into the equipment premises and the racks are cooled by natural ventilation. The amount of air G (volume per hour) and the change rate of air N (l/h) needed for the removal of thermal power P (dimension W) can be calculated by using the following formula:

$$G = \frac{C \times P}{\Delta T}$$

$$N = \frac{G}{A \times h}$$

where:

C = coefficient; C = 20 for American units (C = 3 for metric units)

ΔT = temperature difference between incoming and outgoing air (°C/F°)

A = floor area (m^2/ft^2)

h = room height (m/ft)

The air change rates required by different power densities are presented in the table below (T = 5 °C/41°F and h = 4 m/13 ft).

Table 17. Change rate of air (N) with various power densities.

P/m2	P/sq.ft	N = 1/h
50 W	5 W	N = 7.5
100 W	10 W	N = 15
150 W	15 W	N = 22.5
200 W	20 W	N = 30
250 W	25 W	N = 37.5
300 W	30 W	N = 45

The air inlet and outlet must be designed so that the air velocity does not exceed the limit of 0.5 m/s in the constant occupancy zone and in the area occupied by the exchange cabinets. The fan must contain a filter (for example, F4 AFI II NBS) and a silencer, if necessary.

Forced ventilation, incoming air through the racks

If air is blown separately through the cabinets and the constantly occupied areas, the power density can be raised up to 500 W/m ^{2} (45 W/sqft) without making the temperature or airflow rate unsuitable for the personnel. The air can be blown in through a raised floor or by installing the cabinets on the air vent. The air velocity must not exceed 0.2 m/s.

Backup for forced ventilation

The exchange rooms must have a backup ventilation arrangement to ensure adequate cooling in case of a failure in the primary system or its power supply.

However, natural ventilation may be sufficient to ensure adequate cooling for a period during which the fault in the primary system can be eliminated. We recommend that also in a case like this, there is a temporary, forced replacement system available which can be brought to the premises in case repairing the primary system would take a prolonged period of time.

The figure below describes the use of natural ventilation as a temporary backup system during a repair period. If the ventilation system or the power supply fails, the temperature in the exchange will eventually rise to a temperature (T; see the figure below) which is higher than the temperature allowed for the equipment (T MAX). Note that the rate of temperature rise can be reduced - and the repair period extended - by designing the building and ventilation so that natural ventilation works as effectively as possible during a failure.

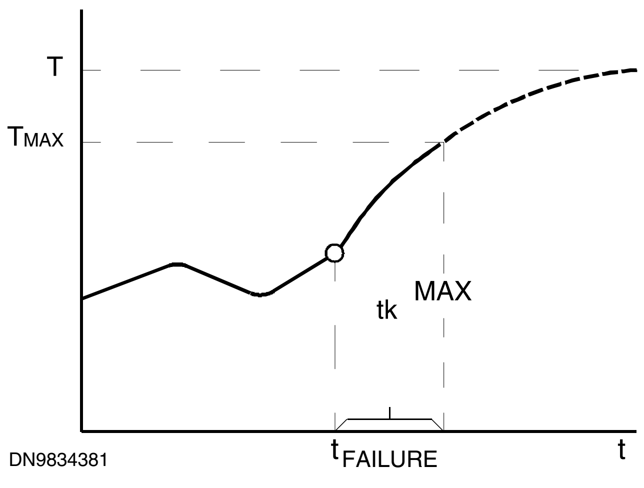


Figure 9. Temperature change caused by failure in ventilation; t = repair time.

In small equipment installations, it is possible that the natural ventilation is sufficient to keep the temperature at a value lower than T MAX. If so, the natural ventilation can be used as a permanent backup for the forced ventilation.

4.2.3 Air conditioning

At stations where some of the rooms are air-conditioned, it is practical to have air-conditioning in the exchange rooms as well. The suitable range of temperature is +18 to +27 °C (+64 to +80F) and relative humidity, 30 to 70%. In these conditions, the failure density of the exchange generally decreases and the working conditions of the operating personnel improve. When air conditioning equipment is used, the maximum power density is 250 W/m ^{2} (23 W/sqf).

4.3 Lights and AC supplies

Recommended lighting near a rack is 300 lx at 1 m (3.3 ft). The most suitable lamps for the equipment room are encapsulated fluorescent tubes.

At least two power sockets (110 V / 60 Hz, 230 V / 50 Hz) should be placed near each rack row for measuring devices and peripherals. The sockets should be provided with permanent isolating transformers. Note that the design of the mains voltage supply to the equipment premises must also conform to local regulations concerning electrical safety.

Caution

All power sockets in the vicinity of the racks of the network element should be isolated in order to prevent connecting the mains supply grounding to the equipment of the network element, and thus causing disturbance. If a permanent isolating transformer is not available, a portable device must be used.

WARNING

Only insulated and isolated electrical devices may be used to install, operate and maintain the BSC, TCSM2 and the equipment premises. This ensures that if a failure occurs, operating personnel will not be exposed to danger of electric shock.

5 BSC and TCSM2 equipment room layout and space requirements

This section describes the rules for the layout of the equipment rooms and the racks used in the BSC and TCSM2.

5.1 Dimensions of the BSC and TCSM2 racks

The racks are made of sheet steel and provided with rear and front doors. They can be mounted free-standing or bolted to installation rails attached to the floor. (Further information is provided in Installing BSC and TCSM2.)The racks are installed side by side into one or more rack rows, each of which constitutes an independent EMC-shielded unit. The doors, the cable duct above the racks, and the steel-sheet covers at the both ends of the row form the shielding.

Listed in the tables below are the net dimensions of the BSC and TCSM2 racks. The Metric units are given in millimeters and the American units (in brackets) in inches or feet.

Table 18. Dimensions of the TCSM2, BSC2 and BSC2i racks.

	Equipment racks		**Cable rack/conduit**	
	BSC2/BSC 2i	**TCSM2**	**R2A1**	**CC19V**
Height, frame	1880 mm (6.17 ft)	1880 mm (6.17 ft)	1880 mm (6.17 ft)	1880 mm (6.17 ft)
Top structure	90 mm (3.6 in)	90 mm (3.6 in)	90 mm (3.6 in)	-
Adjustable feet*	50 mm (2.0 in)	50 mm (2.0 in)	50 mm (2.0 in)	-

Table 18. Dimensions of the TCSM2, BSC2 and BSC2i racks. (Continued)

	Equipment racks		**Cable rack/conduit**	
	BSC2/BSC 2i	**TCSM2**	**R2A1**	**CC19V**
Height, total	2020 mm (6.63 ft)	2020 mm (6.63 ft)	2020 mm (6.63 ft)	1880 mm (6.17 ft)
Width	600 mm (23.6 in)	800 mm (31.5 in)	200 mm (7.9 in)	140 mm (5.5 in)
Depth	450 mm (17.7 in)	450 mm (17.7 in)	450 mm (17.7 in)	450 mm (17.7 in)

*Recommended installation height

The total height - 2020 mm (6.62 ft) - of the TCSM2 and BSC2 racks consists of the following:

- net height of the rack frame 1880 mm (6.17 ft)
- 50 mm (2.0 in) for its adjustable feet
- 90 mm (3.54 in) for the upper structure on top of the rack.

Table 19. Dimensions of the BSCi racks.

	Equipment racks	**Cable rack/conduit**	
	BSCi	**R2A1**	**CC22V**
Height, frame	2200 mm (7.21 ft)	2200mm (7.21 ft)	2200 mm (7.21 ft)
Top structure	150 mm (5.9 in)	150 mm (5.9 in)	-
Adjustable feet*	50 mm (2.0 in)	50 mm (2.0 in)	-
Height, total	2400 mm (7.87 ft)	2400 mm (7.87 ft)	2200 mm (7.21 ft)
Width	600 mm (23.6 in)	200 mm (7.9 in)	140 mm (5.5 in)
Depth	450 mm (17.7 in)	450 mm (17.7 in)	450 mm (17.7 in)

*Recommended installation height

The total height - 2400 mm (7.85 ft) - of the BSCi racks consists of the following:

- net height of the rack frame 2200 mm (7.21 ft)
- 50 mm (2.0 in) for its adjustable feet
- 150 mm (5.9 in) for the upper structure (cable conduit) on top of the rack.

5.2 Dimensioning of the BSC3i cabinet

The width of the BSC3i cabinet (BSCC) is 900 mm (35.4 in) and the depth is 600 mm (23.7 in). In case of raised floor, each cabinet is equipped with a side cabling conduit (SCC) on either side of the cabinet. The depth of the conduit is 75 mm (2.95 in). The total height of the BSCC cabinet 2000 mm (78.8 mm) consists of the following:

- net height of the cabinet 1950 mm (76.8 in)
- 50 mm (2.0 in) for its adjustable feet.

5.3 Rack row dimensions and equipment room layout of BSC and TCSM2

Rack row dimensions

The rear and front doors add 50 mm (2 in) to the depth, and the length of the rack row increases by 80 mm (3.2 in) when the side panels are installed. (See the figure below.)

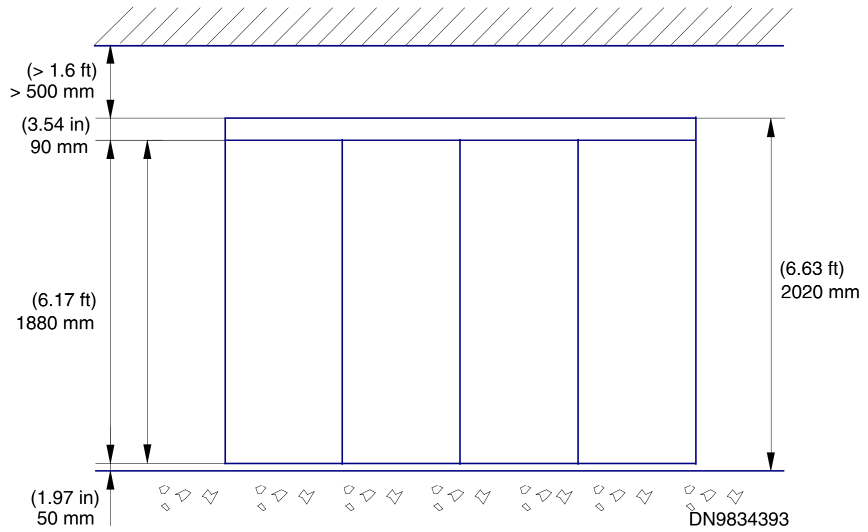


Figure 10. Dimensions of the TCSM2 and BSC2 racks

Note

The rack row dimensions of the BSCi differ from the dimentions mentioned above. For more information, please refer to Table *Dimensions of the BSCi racks*.

Minimum clearances around the rack rows

In the figure below, an example is given of a layout for the DX 200 equipment in the equipment room. The basic layout rules are as follows:

- Both in front of and behind each rack, there must be a free space of at least 1000 mm (3.3 ft); this allows access to each rack from the front and the back.
- Between the ends of the rack row(s) and the walls, there must be a space of at least 500 mm (1.6 ft).
- Due to the dimensioning of the horizontal cable conduits, there must be a space of 1350 mm (4.5 ft).
- Above the racks, there must be at least 500 mm (1.6 ft) of working space.

Any deviations from the above must be agreed upon separately. The placement of a two-rack BSC/TCSM2 rack row, with the required distances to the walls, is shown in the figure below.

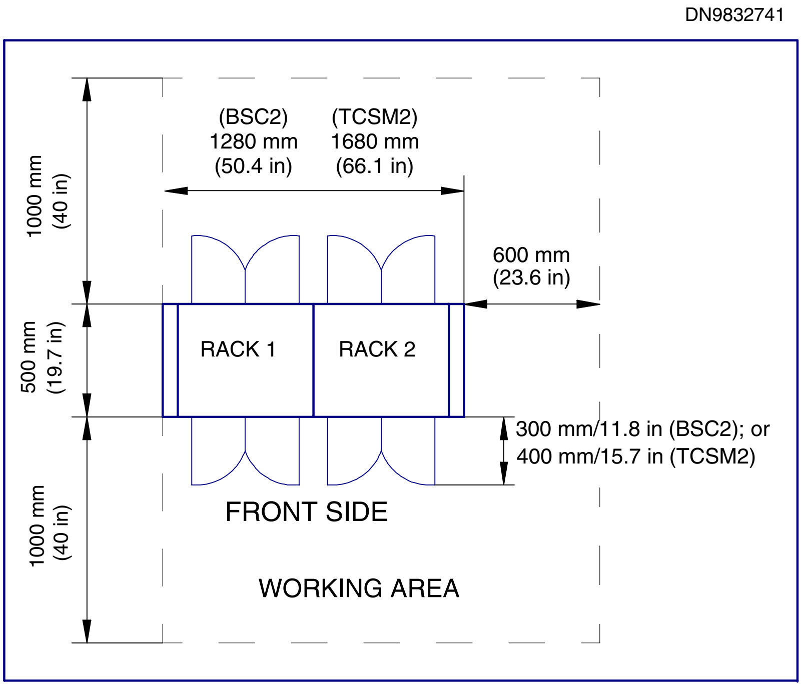


Figure 11. Example of equipment room layout for the BSC or TCSM2

Note

Any number of racks is possible in a row.

In the layout planning of the equipment premises, the following aspects should also be considered:

- cable conduits (CC19V or CC22V) for power supply (and optionally trunk) cables
- cabling racks (R2A1) for BSC and TCSM2 trunk cables
- extendibility
- maintenance passages (width over 1000 mm or 3.94 ft), passage for extension material.

The racks can be optionally attached to the floor of the equipment room using the attachment rail XYHV 1002.

The BSC/TCSM2 equipment layout drawing

The equipment layout drawing is a basic document for the installation. It should be drawn at an early stage as a basis for engineering and contain the following information:

- the location of the equipment in the equipment room
- the names and letter codes for the racks and the direction of the front sides of the rack rows
- the positions of any cable shelves or gratings and the distance of their lower edges from the floor
- cabling routes
- expansion provisions
- the location of control room equipment, where needed.

If two or more DX 200 network elements are installed in the same room, it is recommended that each network element has its own rack row(s). However, the TCSM2 racks can be installed in the same row with the BSC racks.

Before beginning the installation, check the conformance of the equipment room to the layout drawing. Then, mark the positions of the racks on the floor using e.g. masking tape. The reference measurement line is the front edge of the rack. The racks assume their final dimensions when they have been equipped with side plates and doors (see the figures below).

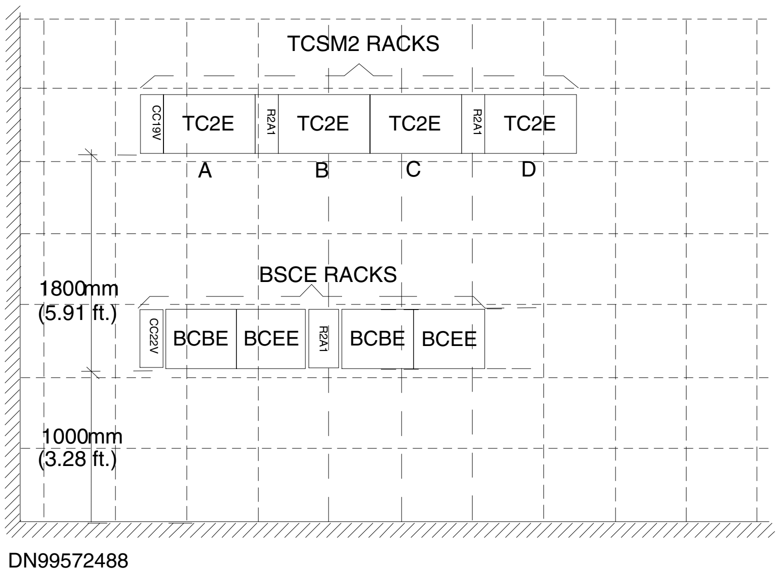


Figure 12. Example of equipment room lay-out for the BSCE and TCSM2

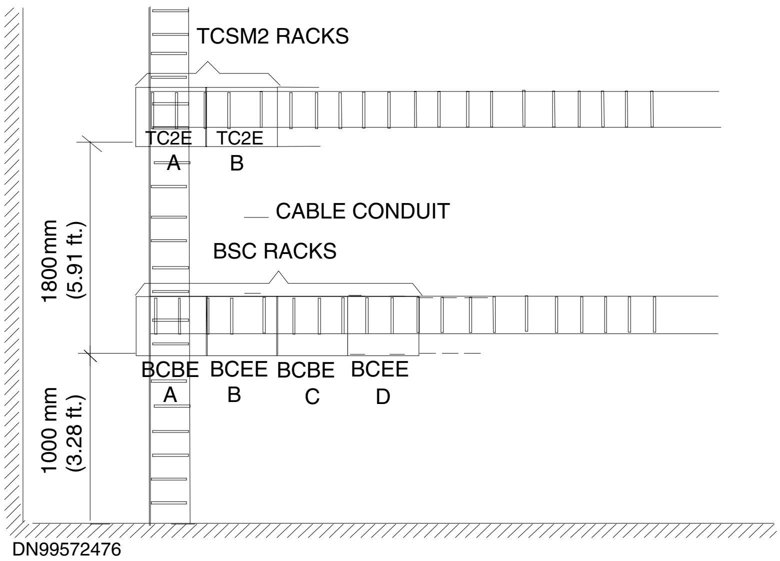


Figure 13. Lay-out example of installation site BSCE and TCSM2

Note

The rack rows can also be positioned as a mirror image of the arrangement shown.

Positions of racks in relation to the floor tiles of a raised floor. The CC19V/CC22V cable conduit and R2A1-S cable rack are optional items designed to aid the routing of the external cabling in raised floor installations. (See the figure below.)

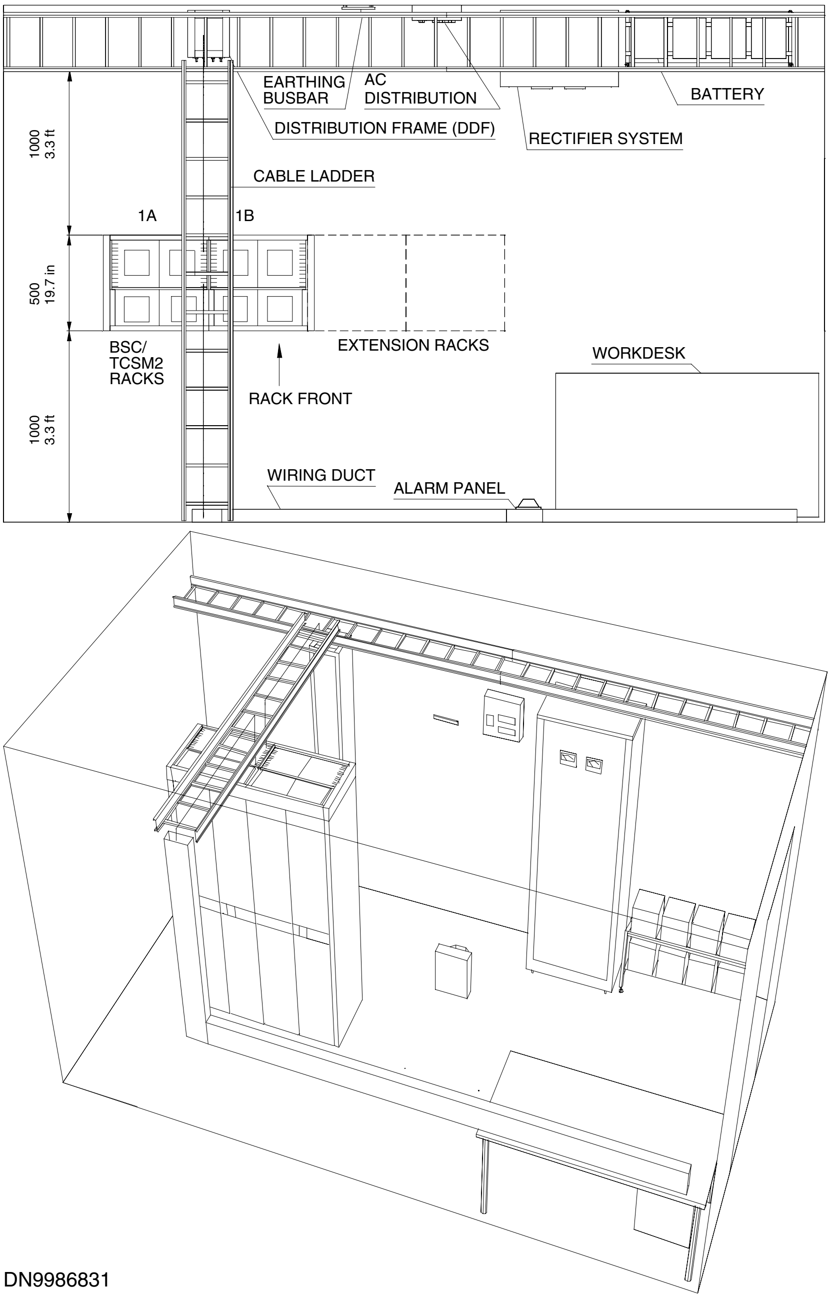


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Figure 14. An example of equipment layout

5.4 Cabinet row dimensions and equipment room layout of BSC3i

The BSC3i network element consists of one cabinet, and each cabinet is an EMC shielded entity. Cabinet dimensions are presented in the figure below.

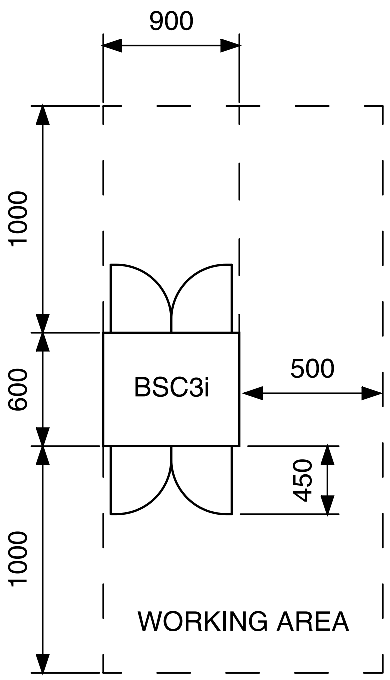

Figure 15. Dimensions of the BSCC cabinet

The BSC3i can be installed either in all equipment rooms, with or without raised floor. When the equipment room has raised floor, the BSC3is are can be installed in cabinet rows so that two cabinets are pushed together as seen in the figure below.

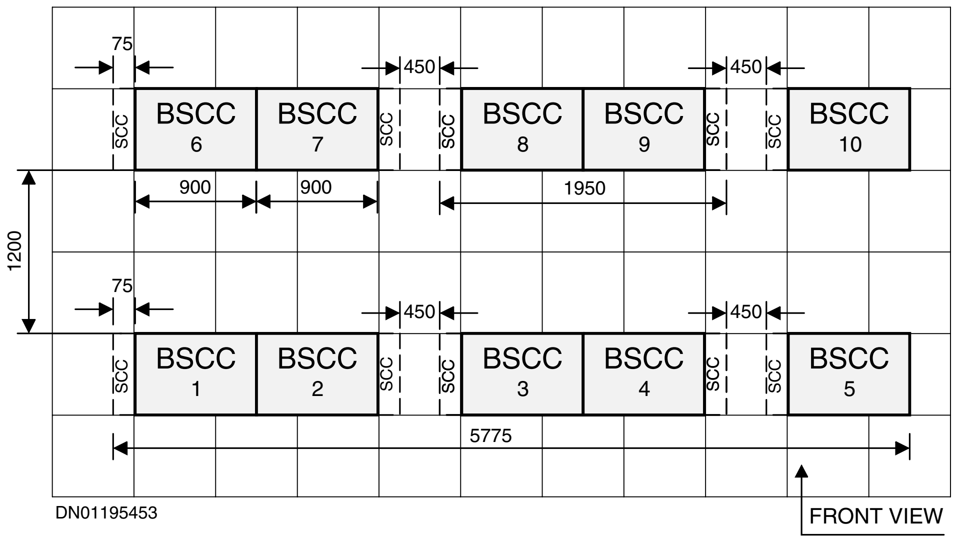

Figure 16. Left-to-right configuration (with raised floor)

Note

The row can also be a mirror-image of the one presented above.

If the equipment room does not have a raised floor, all cabinets can be pushed together as seen in the figure below.

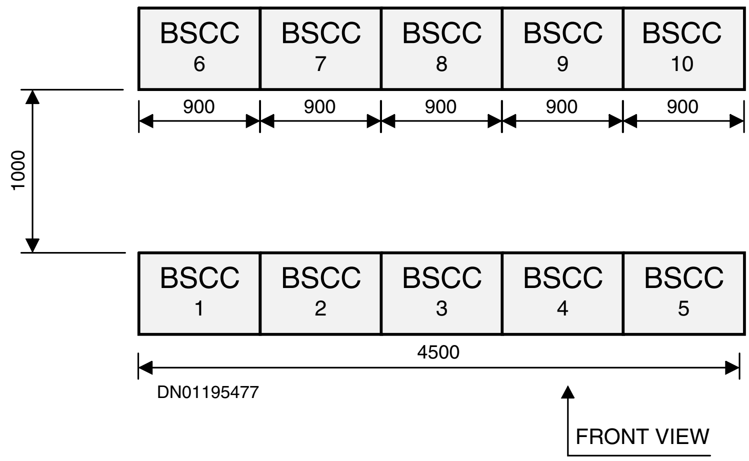

Figure 17. Left-to-right configuration (without raised floor)

Note

The row can also be a mirror-image of the one presented above.

5.5 Floor load for BSC and TCSM2 racks and BSC3i cabinets

The BSC (M92 mechanics) and TCSM2 equipment does not require a raised floor, but it can be used. However, the following requirement concerning floor load must be met: the uniform distributed load capacity is 200 kg/m^2. The maximum weights of the racks are shown in the table below.

Table 20. Maximum weights of the BSC and TCSM2 racks.

Application	Rack	Maximum weight
BSC	BCBE	205 kg (450.5 lb.)
	BCEE	195 kg (428.6 lb.)
	BCBE + BCEE	370 kg (813.2 lb.)
TCSM2	TC2E	240 kg (527.5 lb.)

Table 21. Floor loads for BSC2i in equipment room without raised floor.

Row layout in an exchange room *without* a raised floor	**Floor load (kg/m^2)**
1 * BSC2i in a row	65
2 * BSC2i in a row	92
3 * BSC2i in a row	106
4 * BSC2i in a row	116
5 * BSC2i in a row	122
6 * BSC2i in a row	127
7 * BSC2i in a row	130
8 * BSC2i in a row	133

Table 22. Floor loads for BSC2i in equipment room with raised floor.

Row layout in an exchange room *with* a raised floor	**Floor load (kg/m^2)**
1 * BSC2i in a row	64
2 * BSC2i in a row	87
3 * BSC2i in a row	99
4 * BSC2i in a row	106
5 * BSC2i in a row	111
6 * BSC2i in a row	114
7 * BSC2i in a row	117
8 * BSC2i in a row	119

The BSC3i can be installed in an equipment room with or without raised floor. The estimated floor loads depending on the number of BSC3i cabinets (M98 mechanics) in a row are presented in the tables below.

The maximum weights of the BSC3i cabinet are shown in the table below.

Table 23. The maximum weights of the BSC3i cabinet.

Application	Weight
BSSC cabinet without plug-in units	270 kg (595.6 lb.)
BSSC cabinet with plug-in units	350 kg (771.6 lb.)
Side cabling conduit SCC	10 kg (22.6 lb.)

Table 24. Floor loads in an equipment room with raised floor.

Row layout in an equipment room with raised floor	Floor load (kg/m^2)
One BSC3i in a row	61
Two BSC3is in a row	90
Three BSC3is in a row	97
Four BSC3is in a row	108
Five BSC3is in a row	109

Table 25. Floor loads in an equipment room without raised floor.

Row layout in an equipment room without raised floor	Floor load (kg/m^2)
One BSC3i in a row	64
Two BSC3is in a row	95
Three BSC3is in a row	114
Four BSC3is in a row	126
Five BSC3is in a row	134

5.6 Moving and mounting the BSC3i cabinet

To facilitate moving in the equipment room, BSC3i cabinets are equipped with wheels. The cabinets can be mounted permanently as free-standing cabinets or they can be bolted to installation rails attached to the floor.

5.7 Storing of spare parts and documentation

Spare parts should preferably be stored in another area near the equipment room, which fulfils the requirements set for storage. Spare plug-in units should be stored in their own packaging on shelves or in a cabinet.

The documentation needed for the operation of the network element should be located either in the equipment premises itself or in a nearby room.

6 Cabling and alarms of BSC and TCSM2

The cabling of the BSC and TCSM2 network elements consists of interconnection cables (internal cables) and station cables (outgoing cables).

The interconnection cables include all the cables inside each rack and between different racks. These cables have been cut to length and fitted with connectors at the factory. They are installed according to the cabling plan. For further information on interconnection cables, see the BSC and TCSM2 *Site Documents*, Installing BSC and TCSM2, Engineering BSC and Engineering TCSM2.

6.1 Station cables

The station cables are outgoing cables and include all the cables which leave the BSC and TCSM2 racks. They include:

- PCM trunk circuit cables, which are connected to the connectors on the front panels of the plug-in units
- alarm cables
- grounding cables
- power supply cables
- I/O cables
- X.25 cables (only for BSC2)
- external synchronization cables (only for BSC2 when required).

The sheaths of the station cables, except for the power supply cables, must be grounded at the grounding elements (feed-through EMC gaskets) at the top (or bottom) of the rack when they leave the rack row.

Cable conduits

The station cables of the equipment are normally run above the rack rows. If the equipment room has raised flooring, it is also possible to place the cables underneath the floor. For bringing the cables from underneath the floor to the equipment racks, the following options exist:

- A vertical cable conduit (CC19V/CC22V) can be used for bringing the power supply cables into the rack row. The conduit is fitted at the end of the rack row, alongside the normal side panel, which has an opening at the top. The width of the conduit is 140 mm (5.5 in).
- A cable rack (R2A1-S) can be used for bringing all other types of external cables into the rack row, except for the power cables. It can be fitted alongside the last rack of the row (with the side panel left unistalled), or between two equipment racks. The cables are entered to the cable rack vertically from underneath the floor and then routed on horizontally from the cable rack to the equipment racks. The cable conduit CC19V/CC22V, however, must always be used for routing the power cables, even in case the cabling rack is used. The width of the R2A1-S rack is 200 mm (7.9 in).

The R2A1-S rack is also used if there is need for a horizontal cable conduit (CC132) for cables running between rack rows. The horizontal conduit is installed between two R2A1-S racks placed in the corresponding positions in two adjacent rows, with the ends attached to the top structures of the R2A1-S racks.

Presented in the figure below and in the following table is an example of the use of R2A1-S racks and the horizontal and vertical cable conduit.

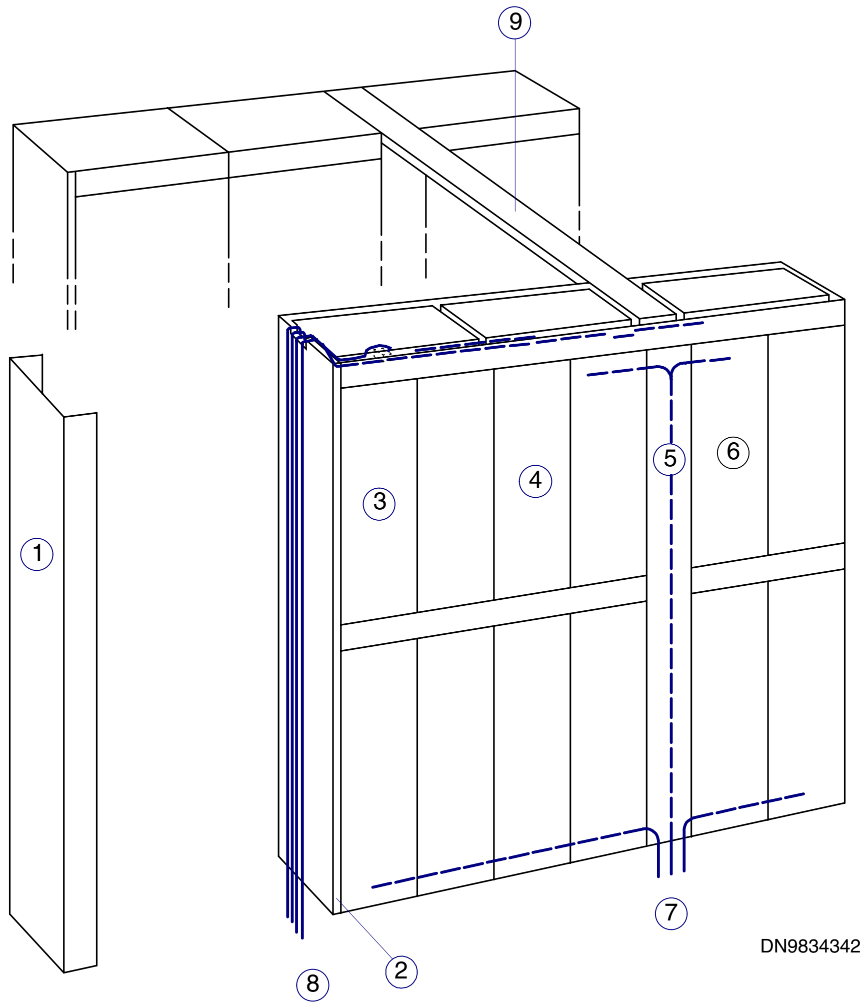

Figure 18. The use of the R2A1-S rack and the cable conduits.

Table 26. Items presented in the figure above.

No.	Item
1	Cable Conduit CC19V
2	Side plate SP19A
3	Rack 1
4	Rack 2

Table 26. Items presented in the figure above. (Continued)

No.	Item
5	R2A1-S rack with grounding element at the bottom (Door set DS192)
6	Rack 3
7	Trunk, alarm and grounding cables either through R2A1-S or CC19V beneath raised floor
8	Power supply cables
9	Cable Conduit CC132 (optional)

PCM trunk circuit cables in the E1 and T1 environment

The BSC2 and TCSM2 trunk circuit cables are mostly cut and connected at the installation site, but they can also be ordered from the factory with one connector installed.

The trunk circuit cables are either symmetric shielded or coaxial cables, depending on the used interface type. Cables of individual interfaces may be grouped into a bundle of cables which have a common outer shield for grounding.

In the E1 environment, two interfaces are available for trunk circuit cabling:

- When a balanced 120 ohm interface is used, the front panels of the ET2E plug-in units are fitted with Euroconnectors with four or eight Euroconnectors in the same trunk circuit cable for connecting PCM circuits (four or eight 2 Mbit/s trunk circuits per cable).
- When an unbalanced 75 ohm interface is used, the front panels of the ET2E plug-in units (BSC, TCSM2) are fitted with SMB type connectors for two coaxial cables (that is, one 2 Mbit/s trunk circuits per two cables).

In the T1 environment, that is, when a balanced 100 ohm interface is used, the front panels of the ET2A plug-in units are fitted with RJ45 jacks for connecting PCM circuits.

The cables of peripheral devices and X.25 connections in the BSC and TCSM2

In the BSC2, the connectors for the VDUs, printers and the X.25 communications interface are in the BCBE rack, with the connectors for the peripheral devices placed in a separate connector panel and the cables for the X.25 communications interface connected to the connectors on the front panel of the plug-in units. The maximum length of the cables is 30 m (33 yd). The cable armatures are connected to metal encapsulated D connectors.

The TCSM2 has connections only for the VDU. They are located in the front panel of the TRCO plug-in units. The maximum length of the cables is 30 m (33 yd). The cable armatures are connected to metal encapsulated D connectors.

Power supply cable

The power supply cables are connected to the terminal blocks of the racks.

Grounding (earthing) the station cables

The metal sheaths (aluminium or copper) of all the cables entering the rack(s), (except for the DC power feed cables from the rectifiers) must be grounded to the rack frame with specific grounding elements (feed through EMC gaskets, also known as grounding combs), which are placed at the top structures of the equipment racks, or at the bottom plates of the cabling racks R2A1-S.

Note

The DC power feed cables from the rectifiers must never be grounded.

6.2 Cable shelves and distribution frames

The cable conduits between and/or on top of the rack rows are a part of the mechanical structure but the DX 200 system construction does not comprise actual cable shelves. Further construction arrangements are decided by the customer individually.

As cable shelves, it is possible to use 300 or 500 mm (11.8 or 19.7 in) wide aluminium profile structures that are mounted to the walls or to the ceiling. However, it is recommended that the shelves are installed above the racks, so that the power supply cables and trunk circuit cables can be installed more easily.

The hardware of the network element may not at any point be galvanically connected to the steel construction or the concrete reinforcement of the building in which the network element is situated. Therefore, the cable shelves must be isolated from the frame of the network element. Lights for the rack row can also be mounted on the shelves, to avoid direct contact with the frame.

Since the distribution frames are not system-specific, they should be designed according to local requirements. Thus, they are not covered in this manual, except for the grounding arrangements (for further information, see Grounding (earthing) of the BSC and TCSM2).

6.3 External alarms of the BSC

Receiving external alarms

The Operation and Maintenance Unit (OMU) in the BSC receives external alarms, for example, from the power units, air conditioning equipment, and pressure supervising devices. The alarms are sent through the cables in groups of 16 to the Hardware Alarm Terminal (HWAT) plug-in unit.

Each alarm is connected to the receiver as a switch-on/switch-off of ground potential (see the figure below). The ground potential difference between the alarm circuit and the network element must be 0.5 V.

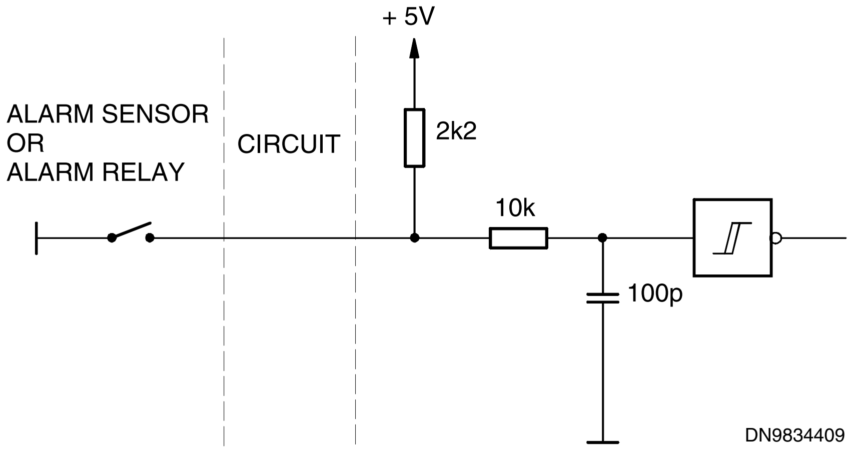

Figure 19. Transmitting and receiving circuits for external alarms

Sending external alarms

The computer unit in the Operation and Maintenance Unit contains 16 alarm control circuits allocated to the external alarm system (see the figure below), which can be used e.g. to control the alarm lamps. The maximum current from each circuit is 28 mA.

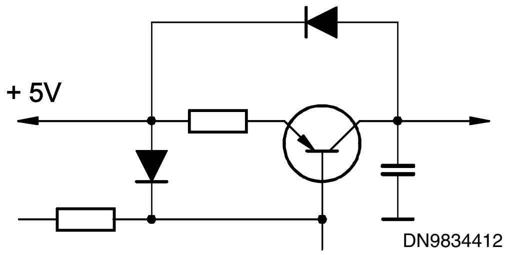

Figure 20. Transmitting circuit for external alarms in OMU

External Lamp Panel for BSC alarm indication

The alarm Lamp Panel (LAMPP, C4207; eight alarms) manufactured by Nokia, with lamps for five alarms, can be used as a separate alarm indicator for the BSC2. The lamp panel allows all the eight alarms to function as relay contact supplies for further handling. The load capacity of a relay contact is 1 A / 48 V_{DC}. External alarm cables are routed to the main distribution frame and to the intermediate distribution frame to be switched onwards. An example of such cable type is CYL.

The alarm signals to the lamp panel are transmitted through cables connecting to the distribution frame. Thus, the relay contact outlets of the lamp panel can be further connected to external alarms defined by the user. The alarm cable to the lamp panel can also be led directly from the OMU (CYL cable), but this solution does not support the relay contact outlet functions of the lamp panel.

Note

The Lamp Panel is not available for the TCSM2.

6.4 Collected power supply alarms of TCSM2 racks linked together

The equipment of one TCSM2 rack can generate a total of four power supply alarms, two by the PSA 20s and another two by the PSFPs. The alarms of up to seven TCSM2 racks can be collected together and sent further to some external equipment. In this configuration, all the internal alarms of a given rack are, as normally, routed to a single cable connector in the first PSFP of the rack. From the PSFP of each rack, an alarm cable runs to a further collecting point located in one of the seven racks, called the mother rack, precisely to the motherboard of its first ET1TC cartridge. From there on, the alarms are transferred as an alarm input via a single cable to some external equipment, typically an MSC. The alarm condition appears as a defined voltage level on the wire.

7 Cabling of BSC3i

7.1 External cables

The external station cables are all cables which enter the BSC3i network elements. The external cables are not included in the delivery and must be ordered separately. They include:

- PCM trunk circuit cables (E1, T1), connected to the front connectors of ET plug-in units
- X.25 cables, connected to the rear connectors of the OMU cartridge
- alarm cables from external devices, connected to the CPRJ45 panel
- LAN cables (100 Mbit/s), connected to the CPRJ45 panel
- LAN cables (1 Gbit/s optional), connected to the CPRJ45 panel, not used in S10.5
- peripheral cables (VDU, PC, printer), connected to the CPRJ45 panel
- external synchronization cables, connected to the CPRJ45 panel

In addition to the abovementioned, the external cables include the following cables, which must also be ordered separately:

- power supply cables
- grounding cables.

7.1.1 PCM trunk cables

The BSC3i network elements have different types of interfaces for the PCM trunk cables for the E1 and T1 environments, as described below.

PCM trunk circuit cables in the E1 and T1 environment

The BSC3i trunk circuit cables are mostly cut and connected at the installation site, but they can also be ordered from the factory with one connector installed.

The trunk circuit cables are either symmetric shielded or coaxial cables, depending on the used interface type. Cables of individual interfaces may be grouped into a bundle of cables which have a common outer shield for grounding.

In the E1 environment, two interfaces are available for trunk circuit cabling:

- When a balanced 120 ohm interface is used, the front panels of the ET2E plug-in units are fitted with Euroconnectors with four or eight Euroconnectors in the same trunk circuit cable for connecting PCM circuits (four or eight 2 Mbit/s trunk circuits per cable).
- When an unbalanced 75 ohm interface is used, the front panels of the ET2E plug-in units are fitted with SMB type connectors for two coaxial cables (that is, one 2 Mbit/s trunk circuits per two cables).

In the T1 environment, that is, when a balanced 100 ohm interface is used, the front panels of the ET2A plug-in units are fitted with RJ45 jacks for connecting PCM circuits.

Preparation of the PCM trunk cables

The trunk circuit cables are usually cut and connected at the installation site. Cables with the switch end connector installed can be ordered from the factory.

7.1.2 Cables for X.25 connections

The X.25 interfaces (V.24, V.35 and X.21) are connected to the special shielded extension cables (CLSC020, CLRC020 and CLTC020). These extension cables are routed through the CPGO panel to the rear connectors of the OMU cartridge.

Grounding (earthing) the PCM trunk and X.25 cables

The metal sheaths (aluminium or copper) of the PCM trunk (E1, T1) and X.25 cables entering the cabinet must be grounded to the cabinet frame with specific grounding elements (feed through EMC gaskets, also known as grounding combs), which are placed at the CPGO panels of the equipment cabinets.

7.1.3 Cables of peripheral devices

Connectors for the shielded VDU and printer cables are located in the CPRJ45 connector panels in the BSC3i cabinets. The connectors used are RJ45 connectors. The typical maximum length of the cables, depending on the transmission speed, is 30 m (33 yd).

The CPU and ESB20 plug-in units have separate interfaces for Service Terminals used for temporary service operations. The RJ45 connectors for these equipment are on the front panels of the plug-in units.

7.1.4 Cables for external synchronization connections

The connectors for shielded external synchronization cables are on the connector panel CPRJ45. The connectors used are RJ45 connectors for balanced (SYMM) interfaces and BNC for unbalanced (ASYMM) interfaces.

7.1.5 LAN/Ethernet cables

The connectors for the shielded LAN cables are on the connector panels (CPRJ45). The connectors used are RJ45 connectors.

7.1.6 External alarm cables

The BSC3i equipment can receive external alarms for example from the power units, air conditioning equipment, and pressure supervising devices. These alarms are transmitted through a shielded cable which connects to the connector panel CPRJ45 in the BSC3i cabinet.

In the OMU, the external alarms are processed by the HWAT-A plug-in unit, where they arrive as a switch-on/switch-off of ground potential. The ground potential difference between the alarm circuit and the exchange must be ≤ 0.5 V.

The external alarms are transmitted to the HWAT-A through one or two cables, which must be routed through a distribution frame.

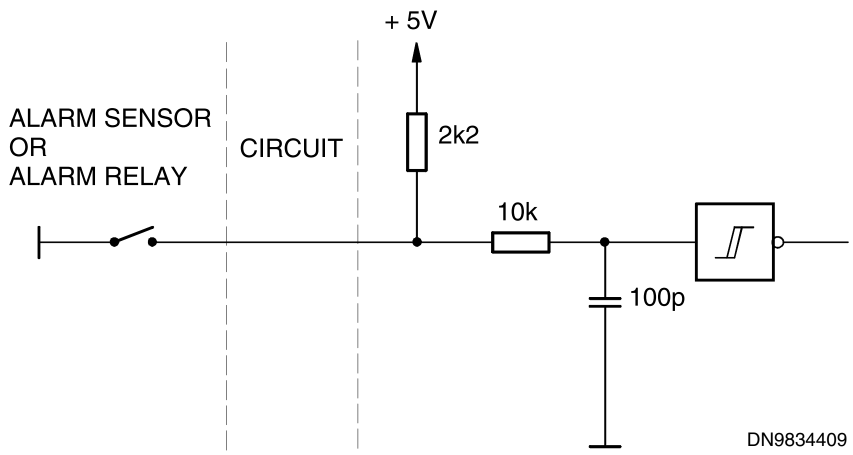

Figure 21. Transmitting and receiving circuits for external alarms

External Alarm Unit EXAU for BSC3i alarm indication

The BSC3i network elements can be equipped with an external alarm unit EXAU. The EXAU houses six replaceable alarm indicator LEDs on the front panel. The EXAU is connected to the CPRJ45 panel with a CNDC cable.

7.2 Cable shelves and distribution frames

The BSC3i network elements require some cable constructions at the site which are not a part of the DX 200 system construction. These comprise the cable shelves (for non-raised-floor installations only) and the distribution frames. The distribution frames are not system-specific and they are therefore not covered in this connection. The requirements for the cable shelves are described in the following section.

Requirements for the cable shelves

In installations without a raised floor, the station cables must be routed above the cabinet rows on separate cable shelves. The cable shelves are attached to the ceiling or a wall, with a separate branch running above each cabinet row, so that the power supply cables and trunk circuit cables can be easily routed.

To prevent galvanic connection between the cabinets and the steel construction or the concrete reinforcement of the exchange building, the cable shelves must be isolated from the exchange frame. Lamps for the cabinet row can be mounted on the shelves to avoid direct contact with the exchange frame.

Aluminium cable racks can be used as the cable shelves. The shelves can be mounted on the walls or to the ceiling.