

**SERIES NG 1500
MOTORWAY COMMUNICATIONS**

Contents

Clause	Title	Page	Clause	Title	Page
NG 1501	Introduction	2	NG 1532	Chambers for Motorway Communication Cables	7
NG 1502	General Requirements	2	NG 1533	Proving and Testing of Ducts	7
NG 1504	Site Records	2	NG	Sample Appendices	A1
NG 1505	Provision of Cabinets, Cables and Ancillary Items	2	<hr/>		
NG 1506	Cables	2	<p style="text-align: center;">NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATIONS OF SCOTLAND, WALES AND NORTHERN IRELAND</p> <hr/> <p>Wales</p> <p>(02/03) The Series NG 1500 Motorway Communications may not be appropriate to Wales. Additional and substitute specifications requirements can be obtained from Welsh Assembly Government, Transport Directorate, Cathays Park, Cardiff, CF10 3NQ.</p>		
NG 1507	Cable Installation	3			
NG 1508	Installation of Cabinets and Signal Posts	3			
NG 1510	Installation of Telephone Posts and Housings	4			
NG 1512	Installation of Ancillary Items	4			
NG 1516	(05/01) Termination and Jointing of Power Supply Cables for Communications	4			
NG 1517	Earthing and Bonding	4			
NG 1518	Cable Testing	4			
NG 1519	Labelling and Numbering	4			
NG 1520	Loading	5			
NG 1521	Removal and Resiting of Existing Equipment	5			
NG 1522	Motorwarn System	5			
NG 1523	Loop Detectors	5			
NG 1524	Trial Pits	5			
NG 1525	Maintaining the Existing Motorway Communications Network	6			
NG 1526	The Inspection and Testing of Electrical Installations	6			
NG 1527	Cable Installation at Transmission Stations	6			
NG 1528	Modifications to Existing Cabinets	6			
NG 1529	Temporary Emergency Telephones	6			
NG 1530	Cable Ducts	6			
NG 1531	Installation of Ducts	6			

MOTORWAY COMMUNICATIONS

NG 1501 Introduction

1 The National Motorway Communications System (NMCS) includes telephones, matrix signals and the associated power supplies and control systems. The Overseeing Organisation should be consulted during the design and preparation of contract documents.

2 (02/03) In motorway construction the installation of cables, cabinets, signal posts, telephone posts and housing will normally be the responsibility of the Contractor. Drawings for motorway installation work from the HCD MCX series drawings, TRH1239, should be included in the Contract as described in Clause NG 003.

3 The Overseeing Organisation will be directly responsible for the installation of the matrix signals and the commissioning of the whole system and will arrange this work by means of a separate contract.

4 As matrix signals are not normally operational at the date of opening of a motorway, Motorway signals must be installed before opening.

5 (02/03) The Overseeing Organisation is responsible for arranging with the electricity supplier for provision of a non-metered (metered in Northern Ireland) power supply for the communications system. The Overseeing Organisation is responsible for negotiating the provision of connections to a telecommunications carrier's private wire network. In both cases negotiations must be initiated and the interface Cabinets 609 erected in sufficient time to ensure that completion of the system is not delayed and power supplies to Cabinets 600 must be available at the time of installation.

NG 1502 General Requirements

1 Motorways should not be opened to traffic unless the telephone system is operational.

2 It is essential that the communications installation is installed and successfully tested 8 weeks before opening to allow adequate time for commissioning.

3 If a Contract contains Sectional completions it may be necessary to make provision in Appendix 15/1 for the appropriate part or parts of the system to be completed 4 weeks before completion of each Section. Testing in sections may also be required.

NG 1504 Site Records

1 'As-built' drawings which should include inserts to a larger scale where layouts are complex, should be produced from daily records. The Contractor should maintain record drawings as described in this Clause. Should additional information be required on the record drawings this should be recorded in Appendix 15/1. If considered practical, one set of drawings can be used for recording both motorway communications and road lighting details (see NG 1402).

NG 1505 Provision of Cabinets, Cables and Ancillary Items

1 (02/03) Cabinets, cables, Cable Joint Enclosures (CJE), telephone housings and posts, and signal posts together with other electrical equipment will usually be supplied to the Contractor direct by the Overseeing Organisation. In such circumstances the Overseeing Organisation will ensure that orders are placed for equipment in good time to prevent shortages and delays in delivery. Equipment will normally become available within 18 months of the date for commencement of the Works but the programme of delivery should be agreed between the Contractor and the Overseeing Organisation and the Overseeing Organisation should be informed of the exact dates by which the equipment will be required. The equipment should be checked upon receipt, recorded and adequately stored by the Contractor.

In circumstances where equipment is not to be supplied by the Overseeing Organisation, the compiler should state in Appendix 15/1 the requirements for those items to be supplied by the Contractor.

NG 1506 Cables

1 Cables will be supplied either by the Contractor or, more usually, by the Overseeing Organisation as specified in Appendix 15/1. The manufacturer's Quality Inspection Certificate for each drum of cable must be checked before it is installed.

2 Only those cables specified may be used.

Non-Armoured Cable

3 (05/01) Communications cable lengths should be in the range 500-530 m. The length of cable is the distance between chambers plus 25 m.

Armoured Cable

4 (05/01) Communications cable lengths in excess of 550 m are not permitted and lengths less than 450 m for longitudinal cables should be allowed only on agreement with the Overseeing Organisation who will provide the appropriate loading schedule.

5 Where appropriate the Overseeing Organisation should be notified when cable is required by the Contractor. The profile of bulk purchase equipment required by sub-Clause 1505.2 should be used for this purpose.

NG 1507 Cable Installation

General

1 All communications equipment must be sited within the motorway boundary. Special attention should be paid to the relative positions of ducts, cables, drains, environmental barriers and safety fences, tree planting areas, signs and lighting columns during the design to prevent subsequent construction or maintenance operations damaging the cables.

Non-Armoured Cable

2 The position of ducts in existing motorways to be used where new schemes overlap them should be ascertained and accurately located on the ground and on the Drawings.

3 Ducts must be provided in accordance with Clause 1530.

4 (05/01) A length of cable (at least 7.5 m) should be coiled in each jointing chamber as shown on HCD Drawing MCX 0873. This is to enable jointing and testing processes to be carried out within a vehicle or tent.

Armoured Cable

5 (05/01) Where practicable, provision should be made for an additional length of the main longitudinal cable at the site of each terminal cabinet to allow for future re-terminations (Ref HCD Drawings MCX 0149 and 0150).

6 As an alternative to laying armoured cables in trench the Contractor may, where permitted in Appendix 15/1, use a purpose-built cable laying machine. It should be of a type capable of forming a slit in the soil before guiding and laying the cable and marker tape without a strain. A sand surround to the cable need not be provided if this method of laying is used.

7 If alternative methods of laying armoured cables in trenches are offered the Contractor may elect to use multi-passes of the purpose built cable laying machine in order to lay several parallel cables instead of laying all the cables in one operation. Care must be taken in such cases to ensure that cables already laid are not damaged by subsequent passes of the machine.

8 Minor sheath repairs to armoured communications cable may be permitted in accordance with Specification MCH 1454.

9 A draw cord attached to a cable and pulled through a duct with the cable is likely to twist around the cable prejudicing future cable pulling operations. Alternative installation methods that leave a draw cord free within the duct should be used. Rods must not be used to install draw cords.

NG 1508 Installation of Cabinets and Signal Posts

1 (05/01) Cabinets are generally expected to be sited near the boundary fences. However, some locations, eg. cut/fill lines may put them in a position where they are particularly vulnerable to damage from vehicles leaving the carriageway. In such cases they should be protected by means of safety fencing or the extension of an existing safety fence. It is recommended that a safety fence should always be provided when equipment is located near the hard shoulder (HCD Drawing MCX 0160). Signal posts should be protected in accordance with the current Standard on safety fences.

2 Power supplies may be provided from a supply point which is either near to or remote from a group of communications cabinets. Where the supply point is greater than 100 metres away from a group or across a main carriageway then an additional power Cabinet 609 should be provided in the group adjacent to the Cabinet 600.

3 Paved areas are required to form platforms adjoining cabinets and gantry bases for maintenance purposes. Easy access must be available to the cabinets as heavy testing equipment needs to be carried to them in all weather conditions. Slopes exceeding 1 in 3 should be provided with steps, and crossings should be provided over ditches, where appropriate. In some cases it may be necessary to site cabinets on a slope thus involving the construction of suitable platforms. All such details should be included in Appendix 15/1.

4 For maintenance and safety purposes it is essential that a consistent layout of cabinets in groups is adopted. The layout to be adopted should be detailed in Appendix 15/1 and, where necessary, on the Drawings.

NG 1510 Installation of Telephone Posts and Housings

1 (05/01) Telephone housings should be installed so that the rear of the housing faces on-coming traffic except that when located next to safety fencing the housing should be turned through 90° to allow access to the instrument from the traffic side of the safety fence (HCD Drawing MCX 0143).

2 In the interests of safety it is imperative that telephones which have not been commissioned and are, therefore, not available for use are covered with "Not in Use" bags. Appendix 15/1 must show if these bags will not be available on loan from the Overseeing Organisation as free issue.

NG 1512 Installation of Ancillary Items

1 Distributive and protective devices must be specified in Appendix 15/1 and may include fused cut-outs, distribution boxes, miniature circuit breakers and/or residual current devices (RCDs) of a suitable rating. Appendix 15/1 must show clearly which equipment is provided by the Overseeing Organisation and which items the Contractor is to supply.

2 Where required, post mounted entry stop signals, which comprise a 1 metre square target board on a Post 75 must be positioned on site to ensure that they are clearly visible before entering on to the motorway and will not be obscured by signs or other street furniture.

NG 1516 (05/01) Termination and Jointing of Power Supply Cables for Communications

1 The requirements for termination of power supply cables must be fully detailed on the Drawings, cross-referenced in Appendix 15/1.

2 It is not physically possible to terminate cables larger than 25 mm² within cabinets; it is therefore necessary to joint the cable to a short length of 10 mm² or 25 mm² cable just outside the cabinet. The smaller cable is then terminated within the cabinet. The location of all such joints should be clearly marked on the drawings and referenced in Appendix 15/1.

3 Joints are only permitted in power cable when prior written approval for the jointing of the cable has been given by the Overseeing Organisation.

4 In power supply cables for communications, approval will not be given for more than one joint in any one cable between terminations, or where the combined length of the 2 cables to be jointed is less than 70 metres.

5 Shortage of cable through incorrect measurement, wilful damage, cable faults, cable damage or such other cases will not be accepted as a justification for cable joints. Such circumstances must be overcome by the Contractor installing a completely new length of cable at his own expense.

6 (05/01) Where joints are permitted, joint markers must be provided and these must be accurately recorded on the record drawings.

NG 1517 Earthing and Bonding

1 The provisions of Clause 1517 are to cover the internal earthing and bonding of the system. In some areas the requirements of the electricity supplier or the results of testing may require additional earth(s) to be provided and these requirements must be incorporated in the design. Specific requirements for earthing and bonding are to be detailed in Appendix 15/1.

NG 1518 Cable Testing

1 Details of cable tests, frequency, reporting etc are to be shown in Appendix 1/5.

2 Where cables do not comply with the specifications listed in Clause 1506 the Overseeing Organisation should be consulted about testing requirements.

3 The cable sections upon which tests are to be carried out must be stated in Appendix 15/1. They are best shown on the loading schedule or on a cable drawing. Sections to be tested may comprise the complete length of longitudinal cable in the Contract or such shorter lengths as circumstances may demand. In some cases, tests may also be called for on lengths of cable, which include lengths previously laid under another contract. If faults are revealed on the latter or any tests fail to produce results, which meet performance requirements, advice should be sought immediately from the Overseeing Organisation.

4 The purpose of sub-Clause 1518.9 is to allow the desiccant packs to remove any moisture from air within the CJE.

NG 1519 Labelling and Numbering

1 The importance of labelling cannot be over stressed and compliance with the Specification is essential to future maintenance operations. Where alternatives are proposed the prior approval of the Overseeing Organisation should be obtained to such proposals.

NG 1520 Loading

1 In certain special situations, and wherever a cable length is less than 450 m it becomes necessary to build out the circuits with appropriate capacitors inserted into the Cable Joint Enclosures (non-armoured cable) or Terminators 13 and 14 (armoured cable) and a loading drawing/schedule will be provided by the Overseeing Organisation to form part of the design. Where significant changes are made in the lengths of longitudinal cables the Overseeing Organisation must be advised without delay.

2 The Overseeing Organisation will provide from stock the necessary capacitors and mounting assemblies.

NG 1521 Removal and Resiting of Existing Equipment

1 It may be necessary to make provision for the removal and resiting of existing communications equipment, particularly at a new motorway interchange with an existing motorway where re-routing of cables is required.

2 Boxes and cabinets and their contents are worth recovery for re-use, but plinths and cables are not. If any equipment is not immediately required it can be stored at the nearest motorway depot for future use. The location of the store should be described in Appendix 2/3.

3 Existing cables which are no longer required should be removed where to do so will not result in consequential damage to the existing in-service cables in order to prevent interference with the operation of the communications system.

4 Clear instructions should be given in Appendix 15/1 as to the removal and disposal of equipment.

NG 1522 Motorwarn System

1 The Contractor should be required to provide and erect the posts and backboard. The Overseeing Organisation will arrange for the supply and delivery of the electrical equipment allowing sufficient time for it to be delivered, and make arrangements for this equipment to be installed either by the Contractor or others. The installer will be responsible for the supply of the cable and suitable cable clips. The appropriate drawings should be included in the design as described in NG 003.

2 Motorwarn is normally located near telephone positions. Care must be taken with siting to ensure that other equipment (such as telephones) is not obscured. Motorwarn sited on slip roads should be visible from the motorway.

NG 1523 Loop Detectors

1 This Clause covers only the installation of the loops and cabinets.

2 Inductive loops should have a minimum clearance of 50 mm above road reinforcement and slots should be at least 1 m in the lateral plane from any ferrous objects such as metal reinforcement bars, chamber covers etc. Also, in concrete road surface, slots should not be cut less than 1.5 m from transverse joints between adjacent concrete sections. Where these requirements cannot be met, detailed discussions/tests will be required in order to establish the design of a viable system.

3 Where supplied by the Overseeing Organisation, it will make arrangements at least 6 months in advance for the delivery of sufficient Cabinets 600 and plinths 610 for the complete installation.

4 (05/01) Clause 1218 covers the requirements of an installation and the HCD Series G Drawings may be used as Contract Drawings where appropriate. The location and type of loop configuration should be shown on suitable drawings after consideration has been given to the effect of any slab reinforcement in the concrete. Sufficient ducts should be included to accommodate the number of feeders required at a particular location.

5 Loop installations should be sited as near as possible to an existing power supply which will usually be taken from a power supply point for the communications system. Failing this an independent supply will have to be provided by negotiation with the local electricity supplier.

6 The Overseeing Organisation will advise on the use of cold poured epoxy resin compounds. Where hot poured sealants are used, it should be noted that to avoid damage to the detector loop insulations, only those for which the manufacturer's recommended pouring temperatures do not exceed 85°C are acceptable.

NG 1524 Trial Pits

1 The method of excavation of trial pits (by hand or other means) and the locations should be described in Appendix 15/1.

NG 1525 Maintaining the Existing Motorway Communications Network

- 1 When undertaking works on existing motorways it is essential that the existing motorway communications system is maintained. The main longitudinal cable forms part of the National Network and any disruption to this cable will consequently affect the National Network.
- 2 The precise method of maintaining the integrity of the system will be dependent upon the Contractor's programme of works.
- 3 Prior written approval must be obtained from the Overseeing Organisation to any proposed change.
- 4 If any element of motorway communications equipment is to be kept operational, arrangements for its maintenance through the Overseeing Organisation's Specialist Maintenance Contractor, must be taken into account in the scheme design and specification for the works.
- 5 Changes to the configuration or maintenance of the motorway communications network must meet the requirements of Specifications MCH 1349, MCH 1593 and MCH 1596.

NG 1526 The Inspection and Testing of Electrical Installations

- 1 The importance of Inspection and Testing cannot be over stressed and compliance with BS 7671 is essential for Health and Safety reasons.
- 2 Where the Contractor finds existing cabinets or installations which do not meet with the requirements of BS 7671 it is essential that he informs the Overseeing Organisation immediately and undertakes no work at that site until further instructed.

NG 1527 Cable Installation at Transmission Stations

- 1 The requirements for cable installation and termination within Transmission Station Buildings including procedures for entry and details of existing buildings must be fully detailed on the Drawings and cross referenced in Appendix 15/1.
- 2 Work in Transmission Station Buildings can only be undertaken under the supervision of the Overseeing Organisation's Specialist Transmission Maintenance Contractor. The work must be identified in accordance with Specification MCH 1593 and programmed in agreement with the Overseeing Organisation.

NG 1528 Modifications to Existing Cabinets

- 1 The requirements for modifications to existing cabinets must be fully detailed on the drawings and cross referenced in Appendix 15/1.

NG 1529 Temporary Emergency Telephones

- 1 The need for Temporary Emergency Telephones will be dictated by the Contractor's programme of works.
- 2 The safety implications cannot be over stressed. It is essential that the location of emergency telephones is clear to motorists and that motorists cannot be put into a situation where the nearest visible emergency telephone can only be reached by crossing either live traffic lanes or the works.
- 3 The maintenance arrangements for Temporary Emergency Telephones must be considered at the design stage. The works specification must take into account the safe access requirements for the Overseeing Organisation's Specialist Maintenance Contractor to maintain the telephones. The changes to the telephone network and its maintenance arrangements must be in accordance with Specification MCH 1349.

NG 1530 Cable Ducts

- 1 (05/01) The only permitted material for cable ducts is plastic, such as PVC-U or MDPE.
- 2 Ducts should be scheduled in Appendix 15/2.
- 3 Mechanical duct plugs should be capable of accepting the combinations of cable types specified.
- 4 The strapping/spacer arrangement must be suitable for the purpose.

NG 1531 Installation of Ducts

- 1 (05/01) Bedding material should be readily obtainable since a wide grading envelope is permitted including most gradings complying with BS 882. It needs to flow readily and compact uniformly, thus a low coefficient of uniformity is necessary. In order to make savings in coarser granular materials a sand bed may be adopted. Surround to ducts should be in accordance with HCD Drawing MCX 0814.
- 2 (05/01) A distinction is to be made between the requirements of bedding, haunching and surrounding and those of backfilling. The former comprise all operations of trench fill up to a level 300 mm above the top of the barrel of the pipe. Backfilling constitutes the remaining operations up to ground level in verges and

open ground and up to formation or sub-formation level under carriageways. Work above formation level constitutes construction or reinstatement of the pavement (see NG 706).

3 Concrete surround should be used exceptionally, eg. for protection of ducts against mechanical damage from subsequent operations after construction of the pipeline and where remedial measures due to over excavation are required. Protection of existing ducts where necessary may take the form of concrete arch or slab above the pipe.

4 Where ducts are to be installed beneath heavily trafficked existing ground, where it is undesirable that the existing ground surface should be disturbed, consideration should always be given to the possibility of inserting the pipe by suitable thrustboring or jacking processes.

NG 1532 Chambers for Motorway Communications Cables

1 Concrete chambers, precast or cast in situ against forms, do not require strengthening with additional concrete surround. Brick chambers do not need a concrete surround for strengthening. It may, however, be necessary to backfill with concrete where a space is insufficient to permit compaction of one of the earthwork's acceptable materials. The types of brick to be used for brick chambers, and beneath chamber frames, in normal circumstances are specified in Clause 2406. Where a different type of brick is required this should be described in Appendix 24/1. Any brickwork upon which chamber frames are seated should be properly constructed.

2 (05/01) Chamber covers should have a minimum opening of 600 mm diameter where personnel may be required to enter completely. In carriageways and hardshoulders where frequent heavy vehicles may be expected, chamber covers and frames should be Grade D400. Reference should be made to BS EN 124 regarding locations where other Grades of covers, gratings and frames will be acceptable. In determining the Grade regard should also be paid to whether the chamber is located behind safety fencing or protected by revetment walls. Special duty covers are being considered including those with a higher skid resistance. Advice may be obtained from the Overseeing Organisation.

3 (05/01) The requirement for cover lifters should be determined by the Planning Supervisor in accordance with the Manual Handling Directive. The chamber cover lifter should be safe and fit for use. Regard should be paid to the available hardstanding area around the chamber.

NG 1533 Proving and Testing of Ducts

1 The air test should be carried out on complete duct lengths ie. from chamber to chamber.

NG SAMPLE APPENDIX 15/1: MOTORWAY COMMUNICATIONS

[Notes to compiler:

1 Appendix 15/1 should be specific for each scheme and provide all the information which a Tenderer requires. Appendix 15/1 should include references to any other specifications and drawings as necessary.

2 Appendix 15/1 should include the following information as applicable:]

- (i) (02/03) whether Overseeing Organisation is to supply and if so whether the Overseeing Organisation is to deliver all cables, etc. equipment [1502.1 (i)], cable ducts and chambers [1502.1 (ii)], Motorway [1502.1 (iii)], cabinets, cables and ancillary items [1505.1], power cable with conductor size [1506.2];
- (ii) (02/03) whether the Contractor is to supply etc. cable fittings [1502.1 (iv)];
- (iii) (02/03) requirements for completion and testing in Sections [1502.2];
- (iv) (02/03) requirements for storage of equipment and cable; include details of dry, heated storage where required and include the items to be stored such as [1505.3];
- (v) (05/01) any additional information to be provided on record drawings [1504.1(xiii)];
- (vi) (02/03) types of communication cable required [1506.1];
- (vii) (02/03) types of power cable required [1506.2];
- (viii) (02/03) references to drawings which show locations of cables, chambers, CJE, cabinets and cable trenches [1507.1, 1507.24 and 1513.10];
- (ix) (02/03) requirements for installation of cable covers [1507.28];
- (x) (02/03) particular requirements for cable laying, additional protection and support [1507.2];
- (xi) (02/03) locations where cable laying by machine is permitted [1507.29];
- (xii) (02/03) requirements for cables following the same route;
- (xiii) (02/03) requirements for staged installation of cable [1507.32];
- (xiv) (02/03) requirements for surface reinstatement to trench [1507.26];
- (xv) (02/03) references to drawings which show construction of paved areas and foundations incorporating plinths for cabinets and signal posts [1508.1];
- (xvi) (02/03) standard cabinet sequence(s) [1508.5];
- (xvii) (02/03) reference to drawings which show construction of paved areas and foundations for telephone posts [1510.1];
- (xviii) (02/03) requirements for orientation of telephone housing if different from the requirements of sub-Clause 1510.2;
- (xix) (02/03) reference to drawings which show location of cable joints and cable joint marker blocks and details of indented mark [1516.2, 1516.9] [cross reference should be made to HCD Drawing II where appropriate];
- (xx) (02/03) references to drawings which show installation details for ancillary items [1512];
- (xxi) (02/03) requirements for reinstatement if different from the requirements of sub-Clause 1521.5;
- (xxii) (02/03) termination requirements for power supply cables [1516.1 1523.3];
- (xxiii) (02/03) requirements for earthing and bonding [1517.1];
- (xxiv) (02/03) cable sections for testing [1518.3];

- (xxv) (02/03) labelling requirements [1519.1,2,4,5 and 7];
- (xxvi) (02/03) details of electrical loading requirements for communication cable [1520.1];
- (xxvii) (02/03) details of existing equipment to be removed or resited [1521.1,2,3,5,6 and 7] [provision for dismantling and storage should be made in Appendix 2/3];
- (xxviii) (02/03) reference to drawings which show approximate positions of Motorway Units [1522.1];
- (xxix) (02/03) details of trial pit excavation; including number, size, method of excavation and locations [1524];
- (xxx) (02/03) requirements for cable installation and termination within Transmission Station Buildings [1527.1];
- (xxxi) (02/03) details of modifications to existing cabinets [1528.1];
- (xxxii) (02/03) requirements for closed circuit television [1534].

NG SAMPLE APPENDIX 15/2: CABLE DUCT REQUIREMENTS

[Note to compiler: This should include:]

- (i) details of chamber covers (grade and whether square or triangular) [1532.10] and details for special duty covers for use in carriageways [1532.10];
- (ii) schedule of chambers - location, depths, types etc [1532.1];
- (iii) schedule of ducts (other than the standard 4 way longitudinal ducts);
- (iv) any special requirements for ducts [1530.1, 1530.2];
- (v) schedule of duct plugs and inserts [1530.7]
- (vi) (05/01) address labels for chambers [1532.15];
- (vii) (05/01) any special requirements for topsoiling, grass seeding and/or turfing [1531.7];
- (viii) any special requirements for chambers [1532.13];
- (ix) maximum length of trench that is allowed to be open at any one time;
- (x) type of lifting keys [1532.11];
- (xi) mass of cover that determines requirement for cover lifters [1532.11].