

Title: **Requirements for
Transportation and Movement
of Large Electrical Equipment
Standard**

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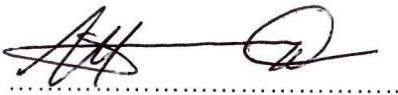
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1. INTRODUCTION

The transportation of large dimension and heavy load electrical components which cannot be moved by rail has generated a requirement for acceptable transport methods and vehicle specifications. Regulations affecting weight and load distribution have influenced the design of specialized trailers and vehicles for abnormal load transportation. The movement of abnormal loads will be confined to the requirements of ROTRAN / approved Transport Company Heavy Transport for the operation throughout the nine provinces of South Africa. The administration of these provinces, in recognition of the requirements for the transportation of indivisible heavy loads over public highways, has collectively established recommendations for the conveyance of abnormal loads within South Africa.

For each load to be transported, separate exemption permits are issued according to the "South African, Conveyance of Abnormal Loads and other events on public roads - TRH11". The safety of the public along the route and through villages and cities is of great concern, and thus travelling will be done when traffic is least congested. Restrictions as imposed over holiday periods with 'embargo's' are enforced with no travel option.

This document sets out requirements which the power station management must ensure are met whenever large equipments are to be transported.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

The purpose of this document is to mitigate the potential risks involved during large electrical equipment transportation from harbour to the various stations and from station to station, from stations to workshops and vice versa and any movement.

2.1.2 Applicability

This standard is applicable to:

- Loads exceeding 80t.
- Transformer
- Generator stator or
- Generator rotor

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 NORMATIVE/INFORMATIVE REFERENCES

2.2.1 Normative

None

2.2.2 Informative

- [1] Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for Other Events on Public Roads – TRH11 (March 2000)
- [2] ROTRAN Transport P.Q.P. Documentation see Annex B.
- [3] Cross-border Road Transport Act 1998 (Act 4 of 1998)

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- [4] South African Bureau of Standards Recommended Practice ARP 007 and 008/1989, Motor vehicle tyre and rims: Dimensions and loads. Pretoria, SABS, January 1989.
- [5] VAN VUUREN, DJ. Die Toelaatbare Wiel – en Asmassas van Swaar Voertuie (Permissible Wheel and axle masses of Heavy Vehicles) DSc thesis, University of Pretoria, 1972.
- [6] GGPP1378 -Generation policy on the control of transportation and movement of large electrical equipments
- [7] Road Transport check sheets A1-A4- retrievable on the GT&A > GTD Web Site:

2.3 DEFINITIONS

Definition	Description
Abnormal Load:	Means a material object which, due to its dimensions and / or mass, cannot be transported on a vehicle or vehicles without exceeding the limitations of either dimension or mass contained in Chapter III, Part Three and Part Four of the Road Traffic Regulations
Appointed Site Representative	Appointed in writing by the business unit to facilitate communication between the road Transport Coordinator and the station, Refer to the policy GGPP 1378 for detail responsibilities.
Exemption Permit	The rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedure to be followed in applying for exemption permits are described and discussed. Legal axle loads limits and the restriction imposed on abnormally heavy loads is defined in relation to the damaging effect on the road pavements, bridges and culverts. The general conditions, limitations and escorts requirements for abnormally dimensioned loads and vehicles are referenced to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles.
Large Electrical Equipment	For the purpose of this document it referred to equipment that exceeds the mass of 80ton and the dimensions denoted as 'Abnormal Load' such as transformers, Generator stator or Generator rotor.
Movement	Include movement of equipment from spare bay or any allocated position to the final position (i.e. any movement of the equipment from one position to another)
Stevedores	Contractor appointed within the harbour to secure and un-secure loads
Transport Company Representative	The person that handles all communication relating to the transport of the electrical equipment. He/she must report on a daily basis, to the respective Project Manager the key reporting principles as laid down in the PQP document
Transport PQP committee	Means the representation by the Site representative and Rotran /approved Transport Company Transport coordinator and a Senior Manager responsible and accountable for the transportation.

2.3.1 Disclosure Classification

Controlled Disclosure: Controlled Disclosure To External Parties (either enforced by law, or discretionary).

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2.4 ABBREVIATIONS

Abbreviation	Description
C.O.G	Centre of Gravity
GT& A	Generation Technology and Assurance
GTD	Generation Technology Department
OEM	Original Equipment Manufacture
PQP	Process Quality Plan
S. A .R .S	South African Revenue Services
S.A.P.O	South African Port Authorities
t	ton

2.5 ROLES AND RESPONSIBILITIES

None

2.6 PROCESS FOR MONITORING

None

2.7 RELATED/SUPPORTING DOCUMENTS

This document can be accessed electronically via the Eskom Intranet and the FTR system. The latest Appendix(es) A1-A4 (Transport check sheets) and Appendix(es)B and C can be retrieved at:GT&A > GTD Web Site.

3. REQUIREMENTS FOR TRANSPORTATION AND MOVEMENT

3.1 REPRESENTATIVES DURING TRANSPORTATION.

This may be different from site to site in terms of having only a project manager or both the Project Manager and a Site Representative whom will coordinate the transport related issues. The responsibilities for the transportation shall be clearly defined in the formalized responsibility chart.

3.1.1 Employer's Representatives

3.1.1.1 Appointment of a Project Manager

The respective business unit appoints a Project Manager to manage, coordinate and plan the logistics from the manufacturing facilities around the world to the delivery ports within South Africa's shoreline and road. These ports are defined based according to their handling capacity are as follows:

- Richards Bay (maximum capacity unlimited >200t)
- Durban (maximum capacity limited <200t)
- Port Elizabeth (maximum capacity <250t)
- East London (maximum capacity <250t)
- Cape Town (maximum capacity <400t)
- Saldanha (maximum capacity unlimited >200t)

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3.1.1.2 Appointment of Site Representative

The road transportation of large equipment requires an appointed dedicated Site Representative whom will be overall responsible to facilitate all communication during transportation project and handling all reports and emergencies during the route. This appointment can be decided by the site well in advance and confirmed in the pre-planning meeting before departure of the equipment. This person must be able to make or give informed decision on actions to be taken in any events.

This appointment of this individual is dependent upon the station; it can be the Project Manager. This person should ideally be the System Engineer. Refer to the policy GGPP 1378 for responsibilities.

3.1.2 Transport Company Representative

ROTRAN/Approved Transport Company to appoint a person that will handle all communication relating to the transport of the electrical equipment. He/she must report on a daily basis, to the respective Project Manager the key reporting principles as laid down in the PQP document. This person should be in position to inform or have access to the correct information about the route and events

3.2 QUALITY INSPECTIONS AND TESTS

- Quality check sheet must accompany the electrical equipment (i.e. Transformer, Generator stator, Generator rotor) until final destination. This means that the quality check sheet will be handed over to the person handling the equipment until it is finally given to the Site Project Manager
- The Quality check sheet must cover all the tests and inspections from factory ex works to arrival on site of the equipment as stipulated below.

3.2.1 Quality checks, tests and inspections are to be done before and after every handling activity:

3.2.1.2 Transformers

- a. Core insulation resistance measurement
 - b. Sweep Frequency Response Analysis (SFRA), transformer to be tested in a “transport ready state” i.e. without oil, dry air pressure in the tank, HV and LV not installed, without coolers, auxiliaries etc:
- This will require installation of test HV and LV bushings, capable to withstand the Sweep Frequency Response Analysis (SFRA) test voltage.

Note:

- SFRA test to be performed at the factory after transformer is prepared for transport, before loading into the ship, after loaded and secured in the cargo hold of the ship, before off loading from the ship, after loading into the trailer and after offloading.
 - The SFRA test equipment to be used is the Doble M5000 series i.e. M5000, M5100, M5200, M5300 etc.
- c. Checking and logging of the gas pressure
 - d. Visual inspection
 - e. Recording of the on board instrumentation status (e.g. Impact recorder)
 - f. Installation of two x 3 directional (X; Y; Z measurement) Impact recorders placed on the active part after the tests, at the test bay has been completed.

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Note: It is preferred that impact recorders measurement is wired to the outside of the tank that is easily accessible from ground level and in an enclosure that is weather proof. This is to be able to interrogate the devices in transit.

- The one impact recorder to be installed is the Shock log RD298 F5 - To measure the humidity, temperature and pressure
- The other impact recorder to be installed in the core is the Shock log RD298 F5 - To measure tilt and roll /sway.
- It must be indicated on the tank of the transformer the X Y Z direction of measurement
- g. Minimum of one Monilog shock display curve R20, mounted on the outside of the transformer tank.
- h. In South Africa, one impact recorder installed by Rotran / approved Transport Company on the outside of the transformer mounted tank, which must be positioned vertical with level heights within the transport beams exclusively positioned to avoid impact from tree branches etc....)
- i. The limits shall be set by the OEM
- j. Over and above the devices installed by the OEM, Rotran / approved Transport Company must install their own impact recorder on the outside of the transformer

3.2.1.3 Generator Stator

- a. Visual inspection
- b. Recording of the on board instrumentation status (e.g. Impact recorder)
 - Two impact recorders must be installed on the outside. This is to be able to interrogate the devices in transit
 - Moisture measurement indicator

3.2.1.4 Generator Rotor

- a. Rotor insulation resistance measurement
- b. Visual inspection
- c. Recording of the on board instrumentation status (e.g. Impact recorder)
 - At least one impact recorders must be installed outside on crate/frame of the rotor. This is to be able to interrogate the devices in transit

3.2.1.5 Example of quality checks of an electrical equipment

- a. An example of a transformer being railed, barge shipped, seas shipped, and road transported to site will be:
 - Before removal from the test bay.
 - After placing in the dispatch bay.
 - Reset recorders prior to starting with transportation.
 - Before loading onto train
 - After loading on the train.
 - Before offloading from the train.

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- After loading on the barge
- Before lifting from barge.
- After loading into the ship
- Before offloading from the ship
- After offloading from the ship.
- After moving at the harbor
- Before loading on truck.
- After incidents on the road
- On arrival at site.
- Before offloading from truck
- After off loading
- After placement in bay.
- Before and after any other intermediate handling (if any).

3.2.2 Transport logistic management

3.2.2.1 At the harbour - Pre-Planning Meeting at the Port Authorities (24hours before the ship docks).

This is viewed as a crucial activity within the responsibility of ESKOM Holdings Ltd. whereby, all the role players attend a pre-planning meeting held within the port where the equipment will arrive at least 24 hours before the ship docks. The meeting is chaired by an S.A.P.O. Manager and a number of representatives are present such as:

- Ships Agent.
- ESKOM Holdings Ltd. appointed Ships Surveyor.
- Stevedores.
- Port Authorities Agents (mobile equipment forklifts, etc...)
- ESKOM's Project Manager and Site System Engineer.
- ROTRAN's/ approved Transporting Company Transport Manager.
- ROTRAN's/ approved Transporting Company Transport Coordinator.
- Freight Forwarding Company (appointed by ESKOM)
- Eskom Transport Consultants

The purpose of a pre plan meeting is to ensure all relevant parties are in agreement with the arrival, offloading and dispatch procedures and sequence.

3.2.3 Process Control during any lifting or movement

Lifting and movement of any load must be done under the supervision of an Authorised rigger and in control of all lifting movement of equipment (i.e. loading, offloading and movement of the equipment) Before any lifting and movement operation the following must be in place:

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- a. The station installation PQP or workshop refurbishment PQP must include as hold point the following activities to be signed off by the station responsible engineer:
 - All Impact recorders to be checked and verified functionality and condition.
 - Assessment and certification of all the rigging equipment's functionality and condition such as:
 - ii. Cables
 - iii. Rails
 - iv. Skit equipment
 - v. Rotor threading equipment
 - vi. Stator lifting device
 - vii. Hydraulic system (i.e. jacks, push and pull etc)
- b. Installation of two impact recorders on the outside of the Generator stator and one impact recorder for rotor prior to any lifting, movement and local transport.
- c. For any lifting, movement or local transportation of transformers, power stations must use at least one impact recorder set i.e. 2 x Shock log RD298 F5 (1x humidity, temperature, pressure sensor and 1 x tilt and roll /sway accelerometer RD404 installed on the active part) and 1 x Monilog shock display curve R20 installed on the transformer tank.
- d. For on site lifting and movement a minimum of one impact recorder must be installed on the outside of the equipment i.e. Movement from spare bay or any allocated position to the final position
- e. For certain electrical equipment movement such as transformers, special approved method or procedure is required, station must ensure that there is hold point for checking the following:
 - Movement of the transformer according to an approved method or procedure i.e. allowed minimum of 4 rails, rails in correct position with reference to the centre of gravity of the transformer.

3.3 MINIMUM MONITORING REQUIREMENTS

On all electrical equipment all instrumentation recording must be time synchronised. Downloading and monitoring all available monitoring points of the impact recorder.

3.3.1 Transformers

- a. Download and monitor all available monitoring points on the impact recorder
- b. Humidity, temperature and pressure
- c. Tilt and roll /sway
- d. Dry air pressure
- e. Visual inspection
- f. Truck record, speed and travelling distance, shock as recorded by the tractor data logger.
- g. Core insulation resistance at low voltage.

3.3.2 Generator Stator

- a. Download and monitor all available monitoring points on the impact recorder.
- b. Moisture measurement indicator

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- c. Visual Inspection
- d. Truck record, speed and travelling distance, shock as recorded by the tractor data logger.

3.3.3 Generator Rotor

- a. Visual Inspection
- b. Rotor Insulation resistance measurement

3.4 MINIMUM REQUIREMENT TO BE INCLUDED IN THE PQP

- a. Insulation measurement (megger) of the equipment before loading into the trailer
- b. Routine activities to be done in the event of incidence that may affect or impact of the equipment
 - Visual inspection
 - Gas pressure of the transformer
 - Moisture indicator of the stator or rotor
 - Condition and functionality of impact recorders

3.5 FORMALIZED RESPONSIBILITIES

The power station management shall be responsible for ensuring that this documentation is in place. Roles and responsibilities must be defined and recorded.

3.6 RECORDS

All control documentation shall be retrievably archived at least for 7 years. All signed documentation including the Transport check sheets; the relevant PQP(s) and the Quality check sheet shall be retrievably archived as part of the electrical equipment history file. It is the responsibility of the Project Manager to ensure that all this documents are signed and filed accordingly.

4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation

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Name & Surname	Designation
	Document Approved by TDAC ROD 13 March 2013

5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0	M. Khumalo	Draft document for Review created from GGS 1384
May 2013	1	M. Khumalo	Final Document for Approval

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- None

7. ACKNOWLEDGEMENTS

- None

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APPENDIX A: CAN BE DOWNLOADED FROM WEBSITE

The latest Appendices A1-A4 (Transport check sheets) and
Appendix B (Example of a high level road transport PQP) and
Appendix C (Transportation process for new equipment at South Africa Harbour) can be retrieved
at:GT&A > GTD Web Site.

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