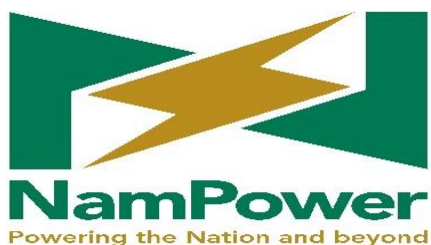


# **NAMPOWER TECHNICAL SPECIFICATIONS PART GN: GENERAL**

**REVISION 01**

**REFERENCE NUMBER: 1/7/2/GNL**



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<b>Referenced Drawings</b>		
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12.44-16222	0	Sample Rating and Diagram Plate for Auto Power Transformers
12.44-16278	0	Sample Rating and Diagram Plate for 2 Winding Power Transformers

## **Foreword**

This Specification forms part of the NamPower Technical Specifications, a series of Specifications specifying various aspects of NamPower's substations, transmission lines and general construction works. This family of Specifications, or parts thereof, is applicable to all new NamPower infrastructure, equipment and assets and/or wherever it is referenced.

For a master list of all the parts of the series of Specifications, please refer to the document entitled *NamPower Technical Specifications Part AA: Master List*, reference number 1/7/1/AAA.

# Table of Contents

Foreword.....	ii
Table of Contents.....	iii
List of Tables .....	v
List of Figures .....	vi
1 Definitions and abbreviations .....	1
2 Introduction and Scope .....	1
3 Normative References .....	1
3.1 List of Standards.....	1
4 General Drawings Specifications .....	2
4.1 NamPower Technical Drawing Numbering System.....	2
4.2 NamPower Technical Drawing Naming System (File Name).....	3
5 Documents/ Drawing Approval Procedure.....	4
6 General Technical Requirements.....	1
6.1 General Service Conditions .....	1
6.2 Nameplates and Labels .....	1
6.2.1 General.....	1
6.2.2 Switchboards, Control, Relay and Distribution Panels.....	2
6.3 Wiring .....	3
6.3.1 Insulation .....	3
6.3.2 Insulation test voltage .....	3
6.3.3 Protection of external wiring.....	3

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6.3.4	Termination.....	3
6.3.5	Communication Cables.....	4
6.3.6	Marking of Wiring.....	4
6.3.7	Identification of wiring .....	5
6.4	MCCBs, Isolators, Fuses and Links .....	6
6.5	Secondary Terminals Blocks.....	7
6.6	Auxiliary Power and Control Cables.....	8
6.7	SURFACE TREATMENT: Cleaning, Protection and Painting.....	9
6.7.1	General.....	9
6.7.2	Choice of Protection and Application .....	10
6.7.3	Preparation for Protection .....	12
6.7.4	Storage and Mixing.....	14
6.7.5	Painting at Site.....	14
6.7.6	Inspection .....	14
6.8	Galvanising.....	15
6.8.1	General.....	15
6.8.2	Preparation and Repair.....	15
6.8.3	Protection of Galvanised Surfaces .....	15
Appendix A: Revision History .....		0
Revision 01:.....		1

## List of Tables

Table 1: Summary of wire numbers to be used in the protection schemes **Error! Bookmark not defined.**

Table 2: Markings of terminals ..... 7

Table 3: Minimum painting requirements..... 11

## List of Figures

No table of figures entries found.

None

# 1 Definitions and abbreviations

All defined terms are capitalised.

**a) Specification:**

Refers to this specific document.

## 2 Introduction and Scope

This Specification is a general specification to be used for the numbering and approval of Contractor generated drawings, marking of equipment, training of NamPower personnel, special tools and equipment and spare parts requirements.

This specification does not contain project specific specifications. It should therefore be applied in conjunction with the project specific scope of works, schedules of finishes, drawings and Particular Specifications. If there are conflicts between this Specification and the before-mentioned documentation, the latter takes preference over this Specification. Where certain aspects of the construction works of a project is not specified, these aspects are to be clarified with the relevant project manager and not assumed.

## 3 Normative References

### 3.1 List of Standards

The following standards or part of the standards will be applicable or partly applicable to this Specification

- NRS003-1



## 4 General Drawings Specifications

### 4.1 NamPower Technical Drawing Numbering System

The number given to a NamPower drawing may have the following characters:

12.44/AAAAA Sheet BBBB Sub-sheet CC Rev DD

where:

- 12.44 is a prefix that determines the drawing categories and is used for most new construction drawings in NamPower. The use of other prefixes will be clearly communicated.
- AAAAA consists of five numeric characters and is allocated sequentially. A range of these numbers can be allocated to a larger project. These numbers will be allocated by NamPower upon application by a Contractor/Supplier.
- BBBB is the sheet number (SHT) and can have a maximum of 4 numeric characters. Sheet numbers are used to sequentially number multiple sheets of the same drawing or drawing set. Numbering of sheets starts at 1 (one).
- CC is the sub-sheet number and can have a maximum of 2 alphabetic characters. Sub-sheet numbers are only used when an additional sheet has to be inserted at a later stage and the renumbering of all higher numbered sheets is to be avoided.
- DD is the revision number and can be a max of 2 alphabetic or numeric characters. Before a drawing is issued for construction, alphabetic revisions are to be used (starting at A). When it is issued for construction, numeric revisions starting with 0 (zero) shall be used. While a numeric revision beyond Rev 0 is being updated, the next revision number followed by a letter is being used until authorisation of the next full revision. Eg. Rev 1A
- Due to slightly different requirements for electrical drawings, 'letter revisions' can be given out for construction.

Examples:

Given a project where a new substation is to be built, consisting of one transformer bay and one feeder bay only. The number range issued to the Contractor by NamPower may be as follows:

- General: 12.44/ 12501 to 12520

The Contractor shall then assign certain sub-ranges to subsections of a project, i.e. bays, or sets of drawings

1. Example: Substation (General): 12501 – 12510

- Bay 1 (Transformer 1): 12511 – 12515
- Bay 2 (Feeder 1): 12516 – 12520

2. Example of 'Revision' Numbering (general):

- 12.44/12501 SHT 01 Rev A – first revision pre-construction issue
- 12.44/12501 SHT 01 Rev B – second revision pre-construction issue
- 12.44/12501 SHT 01 Rev 00 – first revision construction issue
- 12.44/12501 SHT 01 Rev 1B – second revision interim update issue
- 12.44/12501 SHT 01 Rev 01 – second revision construction issue

The Contractor/Supplier shall adhere to this numbering system in addition to any 'In-House' drawing numbering system that might be applicable

## **4.2 NamPower Technical Drawing Naming System (File Name)**

The naming of the final as-built document shall be as follows;

NamPower drawing numbersheetnumber (space) rev number – Drawing description(dot)File type extension

E.g: 12.44\_12501sXX revXX – Drawing description.pdf

## 5 Documents/ Drawing Approval Procedure

Each document for which no approval is required shall be clearly marked "FOR INFORMATION ONLY" in a visible place. NamPower may, however, decide to treat such document as sent for approval, if deemed necessary.

Each document sent for approval shall be clearly marked "FOR ACCEPTANCE" in a visible place. NamPower may, however, decide to mark such document "NOT SUBJECT TO ACCEPTANCE", if deemed necessary.

The Contractor shall in no case distribute any document without either one of the above mentioned marks or his approval of a Subcontractor's drawing or the mark "Approved, Date, Signature". Documents distributed otherwise may be regarded as non-existent.

As far as documents submitted for approval are concerned, NamPower will notify the Contractor by returning one copy marked with one of the following categories:

- Cat. No. 1 : "ACCEPTED IN PRINCIPLE"
- Cat. No. 2 : "REVISED" or "ACCEPTED IN PRINCIPLE EXCEPT AS NOTED"
- Cat. No. 3 : "NOT ACCEPTED"
- Cat. No. 4 : "NOT SUBJECT TO ACCEPTANCE"

The notification "ACCEPTED IN PRINCIPLE" authorises the Contractor to commence or to proceed with the fabrication in compliance with his contractual obligations.

The notification "REVISED" or "ACCEPTED IN PRINCIPLE EXCEPT AS NOTED" authorises the Contractor to commence or to proceed with the fabrication in compliance with his contractual obligations, subject to all corrections noted on the document or submitted on a comment's list, and after he has made sure once again that the work at this state is in full compliance with NamPower's Requirements.

After correction, the document shall be resubmitted for review within two weeks from the date of the former "REVISED" or "ACCEPTED IN PRINCIPLE EXCEPT AS NOTED" - remark, indicating clearly the details of the revision.

The notification "NOT ACCEPTED" indicates that the document must be revised and resubmitted for approval before proceeding with the manufacture.

The notifications "ACCEPTED IN PRINCIPLE", "REVISED", "ACCEPTED IN PRINCIPLE EXCEPT AS NOTED" or "NOT ACCEPTED" shall, however, be understood as result of sample checks only, i.e. it will not prevent NamPower from any further claim during the development of the entire project until issue of the Final Acceptance Certificate.

When the Contractor receives the notification that a document is "ACCEPTED IN PRINCIPLE" by NamPower, he shall immediately enter the mark "ACCEPTED IN PRINCIPLE BY NAMPOWER" in on the original, e.g. on top of the title block, and distribute copies to NamPower as stipulated below within the subsequent two weeks.

If such document is modified for any reason afterwards, it is understood that the previous notification of NamPower is automatically null and void.

The Contractor is hence obliged to immediately notify NamPower of the existence of such further modification, to delete the pertinent remarks from the original, and such document shall undergo the above mentioned procedure once again.

During the preliminary stage of his design work, the Contractor may submit to NamPower drawings and documents for information and general review along with lists of deviations (if any), being basis for eventual design meetings. At the latest when quality, completeness and conformity with the contractual documents have reached a satisfactory level, the Contractor shall submit these documents for approval.

A minimum of 48 hours prior to starting any work, the Contractor shall have in hand copies of the pertinent documents being approved, and shall have supplied the required number of copies to NamPower at site.

NamPower may order the interruption of the execution of any work for which the Contractor cannot present approved drawings. Such an interruption shall not relieve the Contractor from executing his work as stipulated in the Contract and shall be no reason whatsoever for claiming a delay.

## 6 General Technical Requirements

### 6.1 General Service Conditions

The following general conditions shall be considered, if not otherwise stated:

- a) *Outdoor installation;*
- b) *Altitude above sea level: 1 800 m;*
- c) *Ambient air temperatures;*
  - *Maximum: 45 °C*
  - *Annual average: 35 °C*
  - *Minimum: -5 °C*
- d) *Relative humidity: 10% to 95%;*
- e) *Solar radiation: 1.2 kW/m<sup>2</sup>*
- f) *Atmospheric UV radiation: Very high*
- g) *Symmetrical three phase supply voltages (negative and zero phase sequence voltages up to 2%);*
- h) *Seismic conditions: negligible*
- i) *Pollution and special corrosion conditions as indicated in the Technical Schedules.*

### 6.2 Nameplates and Labels

#### 6.2.1 General

All apparatus, plant and equipment shall be clearly and permanently labelled in English, to the approval of NamPower. Where labels are provided for making clear the method of operation of apparatus, they shall be concise and preferably diagrammatic in form. They shall be of such a size as to be readable at normal operating positions.

All equipment shall be provided with permanently engraved labels and number plates secured by fixing screws, to facilitate replacement.

Each item of plant or equipment covered by this Specification shall be supplied, complete with an identification nameplate, clearly engraved or stamped with the Manufacturer's name, plant number and date, together with any other such information that will assist future maintenance and the purchase of spare parts.

Each equipment / apparatus in the substation shall be identified with a unique label. The Contractor must order and install the labels

Nameplates, labels and their fixing screws shall be of stainless steel. Where the use of vitreous enamelled labels is approved, the whole surface including the back and edges shall be properly covered and protective washers shall be provided in front and at the back for the fixing screws.

Labels for similar equipment shall be of uniform appearance and size.

### **6.2.2 Switchboards, Control, Relay and Distribution Panels**

Each main switchboard panel, kiosk and marshalling box shall be adequately and permanently labelled at the front and at the rear with labels of two colour plastic material, matt or semi-matt finished. Labels shall have black lettering on a white background.

Circuit identification name and number labels shall be provided at the front and at the rear of all units. An identical label shall be fitted to the front of all withdrawable moving portions and to the relevant fixed part.

All components such as switches, fuses, relays and other devices, whether mounted inside or on the surface of the compartments, shall have identifying labels which shall be related to the identifying references on the arrangement drawings and wiring diagrams.

For secondary fuses, the current rating of the fuse link shall be shown on the label.

Danger or warning labels shall comply with Section "Warning and Danger Notices". They shall not be mounted on removable parts of equipment.

## **6.3 Wiring**

Wiring shall be carried out strictly in accordance with the requirements of any of the appropriate latest NRS, SABS, IEC or BS Standards and the following supplementary rules.

### **6.3.1 Insulation**

The wiring shall be properly insulated and of CMA grade manufactured in accordance with the appropriate SABS Standard Specification. The wiring insulation shall be oil- and moisture proof. PVC insulated wire shall be of the fire retardant type, insulated to withstand 2kV to earth for one minute.

Where affected by temperatures above that of the ambient air, shall have thermal characteristics at least equal to class 105 of IEC 60085.

### **6.3.2 Insulation test voltage**

All auxiliary circuits shall withstand a test voltage of 2 kV rms to earth and to all other circuits.

### **6.3.3 Protection of external wiring**

External wiring shall be either, in conduit, in a metal protective channel or in the form of armoured cable. Mineral insulated copper sheathed cables shall not be used.

### **6.3.4 Termination**

All wires shall be terminated with suitable crimped lugs, fitted with a compression tool designed for this purpose. All crimped lugs shall be suitable for the terminal equipment on which it is to be terminated. All crimps shall be made with the tool recommended by the manufacturer of the lug and to NamPower's approval. All crimps shall bear a unique identification mark impressed by the tool.

The stripping tool shall be of the type, which allows the length of the strip to be pre-set, and to NamPower's approval. Any "nicked" wiring will be rejected.

If stud type terminals are employed, stranded conductors shall be terminated with tinned (not soldered) approved claw washer or lock nuts, or with approved crimping lug. Separate washers or lugs shall be used for each conductor.

All wiring shall be taken to terminals and wires shall not be jointed or teed between terminal points.

All wiring, external as well as internal, shall be ferrule marked to approval with suitable ferrules. Both ends of the same wire shall be identically marked and shall be consistent with the associated drawings. Transparent Tag Holder Ferrules with White Plastic Tag Inserts of minimum 15 mm length (both Holder and Tag of same minimum length). Font colour is black and height is minimum 3 mm for CAPITALS lettering and numbering of wire labels shall be used. Spare cores shall be marked with their respective cable number in addition to the requirements of NRS003-1, Annexure A

Ferrule markers shall be of a durable insulating material having a reasonable glossy finish to prevent adhesion of dirt. Ferrule markers shall be marked clearly and permanently and shall not be affected by moisture or oil. Unless otherwise approved, ferrules shall be white with black marking. The type of ferrule marker to be used shall be to approval.

Ferrules shall read from left to right on Terminal rails and from the crimped lug to the insulation for relay and equipment terminations.

No more than two conductors shall be connected to any one terminal.

### **6.3.5 Communication Cables**

All communication cables like optic fibre, twisted pair, ribbon and coaxial cables shall be uniquely marked and labelled to the approval of NamPower.

All optic fibre cables, twisted pair, ribbon type and coaxial type communication cables shall be routed separately or individually. They shall be mechanically protected and supported, and shall not rely on control wiring looms for support. Requirements in terms of minimum bending radii shall be observed.

### **6.3.6 Marking of Wiring**

The marking and colouring of small wiring shall be carried out strictly in accordance with NRS003-1 and the following set of supplementary rules:

#### **6.3.6.1 Wiring Codes**

The following wiring codes shall be used;



Earth wires shall be green/yellow.

All other a.c. auxiliary wires shall be black, and all d.c. auxiliary wires shall be grey.

### **6.3.6.2 Interpretation of and additions to NRS003-1**

Numbering shall always be in ascending order from the defined starting point.

Where a starting point is defined as an odd or even number, the ascending numbers shall be odd or even only.

Connections made directly to the secondary terminals of current transformers and to star points in current transformer circuits shall take the lowest number in the group allocated for the purpose. The lowest odd number shall be used for S1 terminal connections and the lowest even number for S2 terminal connections. Preference shall be given to commencing the ascending numbering from the S1 terminal side. Where phase and neutral current transformers are in circuit together, phase current transformers shall take precedence.

The polarity of current transformers shall be determined as follows:

- Terminal P1 shall always be nearest the circuit breaker.
- Terminal P2 shall always be nearest the star point of a transformer.

Numbers shall be skipped where necessary for the possible future addition of items of equipment in series.

The addition of 500 to numbers, where associated equipment on the same panel would otherwise have caused a duplication of numbers, shall be extended to provide for more than two associated sets of equipment by adding 600, 700, 800 or 900 to the numbering of the third, fourth, fifth and sixth similar set of associated equipment respectively.

Numbering of a circuit shall continue in ascending order from the branch point but shall have 100, 200, 300 or 400 added to prevent duplication of numbers already appearing in the main succession numbering. For example, a branch connection from H13 through a coil shall be numbered H114 beyond the coil and shall progress to H116 etc.

### **6.3.7 Identification of wiring**

All equipment boundary/interface terminals and the equipment wires connected to those terminals shall have a unique wire/terminal number in accordance with the manufacturer's

drawings approved by NamPower. The wires shall be marked with black letters impressed on a white background or black letters on a yellow background providing that the colour selected is consistent throughout the panel and/or suite of panels and is to NamPower's approval.

Transparent Tag Holder Ferrules with White Plastic Tag Inserts of minimum 15 mm length (both Holder and Tag of same minimum length). Font colour is black and height is minimum 3 mm for CAPITALS lettering and numbering of wire labels shall be used and shall match the size of wire onto which they will be fitted.

For heavy conductors and very light wiring (telephone type) where the "slip-on" types of marking ferrules are not available, other methods may be approved.

Ferrules shall be arranged to read upright on cable terminal strips and to read from terminal to insulation in the case of relay apparatus and instrument connections.

## **6.4 MCCBs, Isolators, Fuses and Links**

MCCBs, isolators, fuses and links shall be provided as required for the protection and isolating of circuits. The arrangement, type and kA rating of MCCBs and fuses shall be to approval of NamPower.

The MCCBs, isolators, fuses and links shall be mounted vertically in horizontal rows in such a way as to allow easy access and replacement from the front. MCCBs shall be mounted at or near the top of control panels to prevent inadvertent operation by substation maintenance and cleaning staff.

All MCCBs, isolators, fuses and links of the same circuit shall be mounted adjacent to each other.

MCCBs and isolators shall be of the DIN rail mounting type to allow for easy replacement.

Fuses and links shall be mounted on insulated draw-out carriers that hold the fuses or links positively after withdrawal. In all cases the top terminal of the fuse or link shall be the live terminal.

Fuse link holders shall be black and solid link holders shall be white.

All MCCBs, isolators, fuses and links shall be suitably and permanently labelled, displaying the designation and identification number and using the prefix "MCB" for circuit breakers, "ISOL" for isolators, "FS" for fuses and "LK" for links. Current ratings shall also be displayed.

The labels shall not be fixed to removable parts of MCCBs, isolators, fuses or links.

## **6.5 Secondary Terminals Blocks**

Only DIN rail mountable terminals of the Entrelec, Elmex and Phoenix screw clamp with compression spring type shall be accepted.

The terminal blocks shall be at least 500 V grade and shall have 10 A continuous rating or higher as required by the application. The terminal blocks shall be tested with at least 2.0 kV<sub>rms</sub> for 1 minute. They shall be made of moulded, non-flammable thermosetting plastic. The material of the terminal block moulding shall not deteriorate because of varied conditions of heat, cold, humidity, dryness etc., that would be expected at the location the equipment is proposed to be installed.

The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal blocks shall be of the screw clamp, spring loaded insertion type. The terminal width of 10mm is preferred, but terminal widths less than 8mm will not be accepted. The conducting part in contact with the cable shall be tinned or silver plated. The terminal blocks shall be capable of accepting back-to-back insulated hook blade lugs without damaging or deforming the lug.

The terminal blocks shall be of extensible design. The terminal blocks shall have a locking arrangement to prevent its escape from the mounting rails. The terminals shall be rated to carry the maximum current continuously which is expected to be carried by the terminals. The units shall be close fitted to avoid the accumulation of foreign matter between adjacent units. End barriers or shields shall be provided for open sided patterns.

The terminals shall be provided with marking tags for positioning identification.

**Table 1: Markings of terminals**

CIRCUIT	TERMINAL TYPE	DESCRIPTION
Current Circuit	D10/10.ST1.RS	Disconnectable with safety connection

CIRCUIT	TERMINAL TYPE	DESCRIPTION
Voltage Circuit	D6/8.ST1.RS	Disconnectable with safety connection
Signals	M6/8.RS	Non disconnectable with safety connection, used where applicable for all internal connections.
Power supply, AC/DC	M10/10, M16/12  M35/26.FF	Non disconnectable  Heavy duty. For use in circuits up to 1 000 V maximum at maximum continuous current ratings of 125 A.
Ground terminal	M./PI	GNYE, electrically connected to mounting rail

## 6.6 Auxiliary Power and Control Cables

All cables shall be designed, constructed and tested in accordance with the latest revision of relevant IEC standards.

Auxiliary power and control cables shall be of multicore 600/1000V grade, PVC insulated, PVC sheathed & galvanised steel wire armoured. The conductor shall be of Copper (multi-stranded 7 off) with adequate cross sectional area. The conductor shall be sized in accordance with relevant IEC Standards to suit the current carrying capacity, method of installation and ambient conditions specified. The dimensions of the insulation, armour and outer sheath materials shall be governed by the values given in relevant IEC standards.

No joints shall be allowed in any auxiliary or control cable.

## **6.7 SURFACE TREATMENT: Cleaning, Protection and Painting**

### **6.7.1 General**

The protection of all items of plant, supporting metal work, structures, tanks, pipe work, lifting tackle and other metallic items including bolts and fasteners is essential if the plant as a whole is to operate efficiently and in accordance with the design requirements.

While the philosophy of protection is to prevent deterioration by corrosion and is common to all applications, the specific requirements vary according to the materials involved, their function and the active coregents to which they are exposed.

Having regard to the specific locations and functions of metallic items, all surfaces shall be either manufactured from materials with proven resistance to corrosion, under the specific service environments or shall be fully protected from corrosion by approved coatings, paints, electrochemical, or other approved means.

The selection and use of all materials, coatings and anti- corrosion measures is subject to the approval of NamPower and detailed schedules of protection, listing the surfaces concerned and the proposed protection are required. In addition to the summary schedules, the detailed procedures for preparation, application and testing of the protective materials and systems shall be submitted to NamPower for approval. All such submissions will require full details, from the manufacturer, of the protection giving composition and properties of protective materials.

Protection of all internal surfaces e.g. those washed by water, steam, oil and other operational fluids, if of the temporary type, shall be removed completely prior to plant commissioning or if of the permanent type, shall be suitable to withstand all normal and reasonable fault conditions during operation, service and shutdowns. Degradation products of all permanent protectives shall not be harmful to plant, protection or fluids used elsewhere in the systems.

Throughout the cleaning, painting and protection work at site, the Contractor shall ensure that all consumable items are delivered, stored and used strictly in accordance with the manufacturer's instructions and the relevant approved schedules and specifications. The Contractor shall also ensure that during, and on completion of site work, all areas are left in a tidy, clean state and all paint drips, splashes etc. are removed.

All final painting shall be done to the colour code, the details of which will be advised during the Contract and all finishing paints shall be completely compatible with the paints used for protective purposes.

It is the responsibility of the Contractor to co-ordinate the protection proposals for Subcontractor's plant and to ensure that the equipment from all Subcontractors is prepared and protected in accordance with the specification and in a manner ensuring uniformity and compatibility of the protection. The number and type of systems proposed and the number of paint, coatings and protective material suppliers should be kept to an absolute minimum consistent with the purpose and particular application of the protection.

Protection of any surface shall not relieve the Contractor from providing adequate design corrosion allowances, as required by the relevant design codes, specifications and/or functional duty of the plant.

Before painting or filling with oil, gas or compound, all un-galvanised parts shall be thoroughly cleaned, free from rust, scale, burrs, grease and moisture and all external rough surfaces on castings shall be filled.

### **6.7.2 Choice of Protection and Application**

Painting, coating and protective systems shall be selected with proper regard for the function of the item, the preparation, the application requirements and the environment to be encountered during all stages of manufacture, shipping, temporary storage, erection and service.

All coatings and protectives, which are required to withstand service fluids, such as pipe, tank, pump, valve, waterbox and similar linings shall be applied in the works and prior to shipping. The Contractor shall satisfy NamPower prior to acceptance of all such protection that repairs and joints can be adequately and properly made at Site to the standard of the factory applied coatings. In all such cases the use of flanged and bolted joints is preferred, except where the service fluid might on leakage constitute a fire or explosive hazard e.g. lubricating oil systems. In the latter areas it is expected that pipe work and items other than main tanks and submerged or washed major items will be constructed from corrosion resistant materials which will not require protection on internal surfaces.

Structural steelwork, lifting devices and tackle, handrails and similar items may be protected fully prior to shipping or may be suitably primed and finish painted at appropriate stages of erection and completion. In either case, protectives shall be selected to provide the necessary

protection at all stages and such that repairs, overcoating and finishing can be carried out without loss of intercoat adhesion, protection properties (as with an aged anti-corrosion primer) or uniformity of coating thickness. Where items are shipped in a primed or otherwise unfinished condition it is expected that repair and overcoating will be carried out in a progressive manner as erection proceeds so that no undue deterioration of the primer, undercoats and finish coats occurs. Finish painted items must similarly be inspected and repaired, as necessary, throughout the erection programme to avoid the possibility of major repair and rectification work becoming necessary at any time.

Application of all paints and protectives may only be carried out under the conditions specified by the paint or protective manufacturer. Painting and protection work shall not be carried out in any way, which is not strictly in accordance with the Manufacturer's instructions and/or to the satisfaction of NamPower.

Washing of any surface prior to the application and/or overcoating of paint shall only be carried out with de-mineralised water or suitable approved solvent solutions.

Paints shall only be thinned and/or mixed in accordance with the manufacturer's instructions and all paints, solvents, resins, hardeners and associated products shall be stored and used strictly in accordance with the manufacturer's instructions and the applicable toxic, flammability and safety requirements for the particular products.

The Contractor is responsible for ensuring that all safety requirements are fully and completely implemented and for the provision of all necessary safety equipment to fully and completely protect personnel and plant.

The following minimum painting requirements shall apply to all ferrous parts unless the Contractor can show, to the satisfaction of NamPower, that any alternative he proposes is in all respects equal or superior to the specified requirements:-

**Table 2: Minimum painting requirements**

<b>Apparatus</b>	<b>Painting</b>
<b>Internal Surfaces</b>	
Oil filled chambers and tanks	One coat of oil resisting varnish or paint.
Kiosks and apparatus boxes for outdoor use	Three coats of paint, the final coat being an anti-condensation finish.
Cubicles, kiosks and apparatus boxes for indoor use.	Three coats of paint, the final coat being white enamel.
<b>External Surfaces</b>	

Apparatus	Painting
At Works	
All un-galvanised surfaces other than nuts, bolts and washers, in outdoor, which may be removed for maintenance purposes.	One priming coat of corrosion inhibiting paint, applied immediately after cleaning
	Two coats of non-glossy oil and weather resistant paint applied after inspection and testing and before despatch. Or
	A dry powder application to the approval of NamPower.
Exposed, un-galvanised nuts, bolts and washers in outdoor which may be removed for maintenance purposes.	One coat of oil and weather-resistant, non-fading paint applied, after erection.
At Site	
	One finishing coat of glossy oil and weather resisting, non-fading paint applied, after erection is complete. For equipment despatched completely assembled, the final coat may be applied at the Works unless otherwise required by NamPower.
Panels, cubicles, kiosks and apparatus boxes, for indoor use.	Three coats of paint, the colour and finish of the final coat, being to the approval of NamPower.

Successive coats of paint shall be easily distinguishable by shade or colour and shall be applied to a clean, dry and properly prepared surface. Each coat shall be compatible with the previous coat.

All paintwork, which has been damaged during transport or erection, shall be made good to the approval of NamPower.

### 6.7.3 Preparation for Protection

All surfaces to be painted or coated shall be prepared to the requirements of the paint or coating manufacturer and shall in any case be fully equivalent in cleanliness to the SA 3 Standard of SIS 055900 - 1967.



The surface profile shall be that necessary to provide maximum adhesion as advised by the protection manufacturer and shall be such as to avoid measurable thinning or non-uniformity of coating thickness.

All edges and corners shall be made smooth. All weld undercut, over- beading flow markings and likewise any irregularities, which may result in thinning or overstressing of the paint or coating, shall be removed prior to blast or other approved cleaning process.

Particular care shall be taken prior to the application of any protective, to ensure that the surfaces are free from chemical impurities and contaminants of any description. In all cases of reasonable doubt, particularly at welds and crevices where alkaline deposits may concentrate, checks shall be carried out by approved methods, to ensure freedom from contamination prior to the application of any paint or protective.

In general, it is expected that preparation for protection will involve either blast cleaning or chemical cleaning. Abrasives and/or chemical solutions shall be to the approval of NamPower and neither shall leave any potentially harmful residues or other contaminants on the cleaned surfaces.

The use of an etching primer will normally be expected for the preparation and painting of galvanised steel or other non-ferrous metal surfaces.

If protection of cleaned surfaces is for any reason delayed such that the cleaned surface becomes contaminated either by 'in situ' corrosion or by deposition, the complete cleaning procedure shall be repeated. In the case of large items, it may not be possible to complete protection within the necessary time, to prevent deterioration of the cleaned surfaces. It is necessary, in all such cases, to clean only those surfaces which can be reasonably protected in the time available, having proper consideration for the protective system used its curing time and the difficulties or problems associated with obtaining the required adhesion and continuity between already painted surfaces and newly painted ones.

Repair of multi-coat systems shall be avoided wherever possible and in all cases where such repairs are necessary, repairs and adjacent areas shall be subsequently overcoated with an additional full coat of the approved finishing paint, to NamPower's approval.

### **6.7.4 Storage and Mixing**

The Contractor shall ensure that the storage of all paints is to the Manufacturer's recommendations and under no circumstances shall paint be used whose shelf life has been exceeded.

The mixing of two pack paints shall be strictly in accordance with the Manufacturer's recommendations.

### **6.7.5 Painting at Site**

Where painting at Site is to be undertaken, the Contractor shall ensure that the prevailing climatic conditions meet the paint Manufacturer's requirements. Under no circumstances shall painting in adverse climatic circumstances be undertaken.

Items delivered to Site in a primed condition and intended to be overpainted at a subsequent date e.g. after erection, shall be maintained in a condition suitable for subsequent painting, taking into account all reasonable Site conditions and problems. Pre-fabrication primers are not acceptable as protection for shipping and site storage.

The Contractor shall take all necessary measures to protect plant and equipment from mechanical damage and/or contamination with solvents, paint, abrasives, dust and other foreign materials, during both preparatory work and the application of protective paints and coatings. In the event that damage and/or contamination occur, the Contractor is responsible, at his own expense, for full rectification to NamPower's satisfaction.

### **6.7.6 Inspection**

All stages of preparation, application and repair shall be subject to NamPower's approval. Surface finish and condition prior to application of any protective coating, wet and dry film thickness checks and continuity checks shall be carried out by the Contractor. The Final Certificate will not be issued until all paintwork, protection, finishes, surfaces etc. satisfy NamPower.

In addition to visual inspection, it is expected that checks of paint dry film thickness, continuity and uniformity will be carried out by the Contractor, on all painted and protected surfaces and the equipment, and procedures proposed should be detailed and submitted to NamPower for approval.

## **6.8 Galvanising**

### **6.8.1 General**

Galvanising of iron and steel articles shall be carried out by the hot dip process and generally in accordance with an approved standard to give a minimum average coating weight in excess of 600g/m<sup>2</sup> and shall be clean, of uniform thickness and free of defects.

Surfaces that are in contact with oil shall not be galvanised or cadmium plated.

The identifying marks on any galvanised parts shall be stamped before galvanising is applied and shall be clearly legible afterwards.

Zinc coated fasteners such as nuts and bolts should be lubricated with beeswax or other suitable lubricant, prior to fitting and tightening.

### **6.8.2 Preparation and Repair**

The preparation for galvanising and the galvanising itself shall not adversely affect the mechanical properties of the coated material.

All fastenings which are used for regular inspection and maintenance must be treated by a zinc passivation process.

All possible welding, drilling, punching, cutting and bending of parts shall be completed and all burrs removed before galvanising is commenced. Small areas of galvanised coating, damaged during transit and erection or by cutting and welding at Site shall be removed, to the satisfaction of NamPower. Such repairs to the coating will be made by use of either low melting point zinc alloy repair rods or powders made specifically for this purpose. If, in the opinion of NamPower, the damage is local and can be repaired by applying a coat of galvanising repair paint, the damaged area shall be cleaned by wiping with clean rags saturated with mineral spirits or xylene, followed by wire brushing. After wire brushing, the area shall be re-cleaned with solvent to remove residue and shall be given a minimum of two coats of zinc rich paint, in accordance with the Manufacturer's instructions.

### **6.8.3 Protection of Galvanised Surfaces**

If, on Site, any galvanised surfaces are to be externally visible, the Contractor shall take precautions to avoid wet storage, staining of freshly galvanised articles during transport or storage.



## **Appendix A: Revision History**

**Revision 01:**

<b>Page/Section number:</b>	<b>Change:</b>	<b>Notes/Reason:</b>
Page 3/ Section 6.3.1	Insulation details updated	Update requirements.
Page 5/ Section 6.3.6.1	Added new section on "Wiring codes"	New section added to provide details on wiring codes
Page 6/ Section 6.3.7	Deleted the section on Wire numbering	Details no longer required
Page 8/ Section 6.5	Updated details on the Secondary Terminal Blocks	Align the secondary terminal blocks with the rest of the HV equipment