

Requisition

Discipline	Name	Signed
Process	T. vd Mast	N.A.
Mechanical	J. Hoogeveen	N.A.
Instrumentation	M. Kuipers	
Civil	T. Alberts	
Building services	L. Hofhuis	N.A.
Infrastructure	T. Robbertsen	
Pipelines	N. Oude Vrielink	N.A.
HSE	E. van der Putten	N.A.
Project Management	K. Dambrink	



Requisition for Compact stations & Walkable enclosure

March 28, 2025

Bilfinger Tebodin Netherlands B.V.
Jan Tinbergenstraat 101
7559 SP Hengelo
The Netherlands

Client: Nederlandse Gasunie N.V.
Project: Underground Hydrogen Storage UHS - HyStock
Order no.: nIT57690
Document no.: S.003843-EF-A435-308
Revision: B

This requisition covers the minimum technical requirements for the engineering, design, supply of materials, fabrication, assembly, inspection, factory testing, shipment to the job site, Installation on-site, start-up, training of operators, acceptance test, quality assurance and vendor documents for the specified equipment in accordance with the documents listed below:

TAG nr.	Equipment name	Quantity
TR-L0901 TR-00001, TR-00002 & TR-00003	Compact stations for construction power, minimum 2 sections: - section 1 → 33/0,41 kV transformer 400 kVA (PART OF SCOPE) - section 2 → LV switchgear 1x incoming & several outgoing feeders + Socket Outlet rack to be mounted close to the compact station.	4
TR-Z0901 & TR-Z1001	Compact stations for construction power, minimum 2 sections: - section 1 → 33/0,41 kV transformer 400 kVA (PART OF SCOPE) - section 2 → LV switchgear 1x incoming & several outgoing feeders + Socket Outlet rack to be mounted close to the compact station.	2
TR-00005	Walkable enclosure for E-drilling, minimum 2 sections: - section 1 → <u>33/20 kV transformer 6,3 MVA (NOT PART OF SCOPE)</u> - section 2 → 20kV switchgear 1x incoming & 2x outgoing feeder	1

OPTIONAL:

-	List with all required accessories, special tools and spare parts (2 years) for compact station	1
-	List with all required accessories, special tools and spare parts (2 years) for walkable enclosure	1

B	March 28, 2025	Original for nIT57690	M. Pluijmen 	R. Smeets 	J.J.P.H. Hoefsmit
A	June 27, 2024	Original for nIT57690	R. Ottes	H. ter Veld	J.J.P.H. Hoefsmit
Rev.	Date	Description	Author	Checked by	Approved

-	One (1) day FAT for compact station in the manufacturers factory, FAT findings of the first compact station shall be adapted in the other compact stations.	1
-	One (1) day FAT for walkable enclosure in the manufacturers factory	1

Chapter 4.1 of the material specification indicates the split of prices in the quotation.

Document number	Name of document	Rev.	Date
S.003843-EF-A435-308	Requisition – Compact stations	B	28-03-2025
S.003843-EF-A435-308_Att_A	Material specification – Compact stations	B	28-03-2025
S.003843-EF-A435-308_Att_B1	Typical 1 – Compact station 400 kVA	B	28-03-2025
S.003843-EF-A435-308_Att_B2	Typical – Compact station 6,3 MVA	A	27-06-2024
S.003843-EF-A435-308_Att_B3	Typical 2 – Compact station 400 kVA	A	28-03-2025
S.003843-EF-A435-308_Att_C	Layout – Compact stations	A	27-06-2024
S.003843-EF-A435-308_Att_D	Requirements for Documents – Compact stations	A	27-06-2024
S.003843-EF-A435-308_Att_E	Material specification – Distribution Transformer (VBS-09-E), including: - Requirements for Documents (RED)	n.a.	27-06-2020
S.003843-EF-A435-308_Att_E-1	Datasheet – Transformer 400 kVA	A	27-06-2024

Quotation shall be based on the information submitted via this requisition. Please be noticed that some of the details are NOT final (indicated with PRELIMINARY), these will be submitted/discussed later. The attached datasheets shall be part of the quotation with for each line indicated: confirmation / deviation (red cells) or vendor input (blue cells).

For each TAG numbered item a full set of vendor documentation (according to the RED) shall be delivered.

MATERIAL SPECIFICATION

Specification no.: S.003843-EF-A435-308_Att_A

Version : B

Date : 28-03-2025

Page : 1 of 15

COMPACT STATIONS &
WALKABLE ENCLOSURELocation:
Gasunie Zuidwending A-435Project:
Underground Hydrogen Storage (UHS)
HyStock

NAME	INITIALS	DEPARTMENT	DATE
(Made by) M.Pluijmen	MPMN 	Bilfinger-Tebodin	28-3-2025
(Checked by) R.Smeets	RSMS 	Bilfinger-Tebodin	28-3-2025
(Approved by) J.J.P.H. Hoefsmid	JHOT	Gasunie	28-3-2025

Department : Electrical
Project nr. : S.003843
Location nr. : A-435
Location name : Zuidwending

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Inhoud

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1. SCOPE AND APPLICATION

1.1 Scope

This specification gives the minimum technical requirements for the design, manufacturing, assembly, testing, transportation, installation on site and commissioning of the compact stations & walkable enclosure for the Gasunie project "Underground Hydrogen Storage – UHS HyStock.

This specification, together with the attachment give the requirements for the design of the compact stations & walkable enclosure.

Installation of external cables (site cabling) is NOT part of scope of supply.

1.2 Application

This specification is applicable for compact stations made for Gasunie:

- Detail design, assembly, protection settings (submitted by Gasunie) and Factory acceptance test of 6 compact stations + 6 socket outlet racks:
 - o TR-Z0901
 - o TR-Z1001
 - o TR-L0901
 - o TR-00001
 - o TR-00002
 - o TR-00003
- Detail design, assembly, protection settings (submitted by Gasunie) and Factory acceptance test of 1 walkable enclosure:
 - o TR-00005
- Transport and installation on site.
- Commissioning support (Gasunie (IV-er) will perform the commissioning).

This specification covers both the compact stations (for 400 kVA transformer) and the walkable enclosure (for 6,3 MVA transformer), specific details are indicated clearly.

2. REFERENCES

This specification is subject to the requirements of the documents mentioned in this clause. Latest issues are always applicable, unless clearly stated.

2.1 Gasunie specifications

Reference is made to the following Gasunie standards:

OSE-01-N	Low voltage installation design
CSA-38-E	Safety, health and environmental management at construction sites (bilingual document).
CSE-N/1	Construction of Electrical and instrumentation installations.
CSE-N/2	Earthing provisions and lightning protection equipment.
MSA-24-N	Tag number and name plates.
MSA-25-E	Transport, packing and marking.

2.2 Standards

Reference in this specification is made to the standards mentioned in this subclause. Any supplements and errata notices are also applicable.

NEN-EN-IEC 60270	High-voltage test techniques / Partial discharge measurements.
IEC 60529	Degrees of protection provided by enclosures (IP Code)
NEN-EN-IEC 61439	Low-voltage switchgear and controlgear assemblies
NEN-EN-IEC 61936	Power installations exceeding 1kV AC and 1,5 kV DC
NEN-EN-IEC 62271	High-voltage switchgear and controlgear - Part 202: AC prefabricated substations for rated voltages above 1 kV and up to and including 52kV
NEN 1010	Low-voltage electrical installations (applicable for LV compartment of the cubicles)
NEN 3140	Operation of electrical installations – Low voltage
NEN 3840	Operation of electrical installations – High voltage

3. DEFENITIONS AND ABBREVIATIONS

3.1 Definitions

In this specification the following definitions are applicable:

Vendor	Is the party that has an agreement for manufacturing and delivery of the equipment and auxiliaries as described in this specification with all its annexes/attachments. Including the rendering of all services forming part of the delivery.
Client	Purchaser/client, N.V. Nederlandse Gasunie

3.2 Abbreviations

In this specification the following abbreviations are applicable:

AC	Alternating Current
CB	Circuit Breaker
CE	Conformité Européenne = European Conformity
DC	Direct Current
EMC	Electromagnetic compatibility
FAT	Factory acceptance test
HSV	High voltage switchgear (HoogSpanningsVerdeler)
HV	High Voltage ($U > 1\text{kV}$)
kV	Kilo Volt
kVA	Kilo Volt Ampere
LSV	Low voltage Switchgear (LaagSpanningsVerdeler)
LV	Low Voltage ($U < 1\text{kV}$)
MCB	Miniature Circuit Breaker
RED	REquirements for Documents
SAT	Site Acceptance Test
XLPE	Vernet polyethylene (Croslinked Polyethene)

4. REQUIREMENTS FOR INQUIRY AND QUOTATION

The quotation shall include an extensive description of the compact stations & walkable enclosure and shall be written in English.

Any conflict between the requirements of this specification and related codes, standards, data sheets, drawings and the like shall be referred to CLIENT for clarification.

Assumptions to cover lack of information are not allowed. VENDOR is obliged to obtain reliable information from CLIENT.

VENDOR shall submit a list of all appliances, special tools and accessories that are necessary for the proper installation, operation and maintenance of the equipment, even though these items are not included on the drawings, specifications or data sheets.

VENDOR shall fully describe all deviations from this specification, data sheets and the related codes.

4.1 Price

The proposal shall include the total project price and, in addition, separate prices for the following items:

- unit;
- transport and installation on site;
- the total testing as described in this specification (FAT & SAT);
- accessories, special tools and spare parts;
- documentation.
-

4.2 Scope of supply

The VENDOR has the overall responsibility for the supply of the equipment forming part of this specification in accordance with the requirements of this specification. This overall responsibility shall include, but is not limited to:

- Project Management and co-ordination for all the work performed by the VENDOR as well as for the work performed by its sub-Vendors, taking unit responsibility for the complete equipment.
- Engineering, design, procurement, manufacturing, testing, inspection, delivery, expediting and mounting of all necessary equipment and material.
- Expediting and inspection of equipment and materials in (sub) VENDOR's scope of supply.
- Quality Assurance and -Control (QA / QC) to ensure compliance with the requirements in this specification
- Submission of all documentation as required by this specification. The required documents and the submitting times, for each item are described in the "Requirements for Documents (RED) forms:
 - For compact stations & walkable enclosure
(see document S.003843-EF-A435-308_Att_D)
 - For 400 kVA transformer(s)
(see document S.003843-EF-A435-308_Att_E, annex C).
- All formal approvals for equipment where required by the authorities.
- All accessories (safety locks, etc), special tools (voltage indication measurement sticks, etc) and spare parts (fuses, etc.)

Compliance with this specification and referenced standards does not relieve the VENDOR of its responsibility to furnish equipment of proper design, workmanship and materials to meet the specified operating conditions and duties.

All equipment supplied by the VENDOR shall be within the range of VENDOR's proven experience and shall not involve the use of any prototype design or components. VENDOR shall inform CLIENT, with the proposal, of any recent design developments or - improvements of the equipment offered.

All labour and materials necessary to complete the delivery of a fully functional compact station & walkable enclosure are to be furnished by VENDOR.

4.3 Planning schedule

The VENDOR is to provide, as part of his proposal, a planning of the project. The planning shall show all significant events such as engineering, fabrication, installation on site, testing, transportation, installation at site and commissioning.

5. Design requirements

The design of electrical installations must be in accordance with the national applicable standards. Applicable are the relevant NEN standards that are mentioned by name and the regulations in this field of government and electricity suppliers.

The design of an electrical installation must be such that the installation functions safe and reliable under all operational conditions. The provider shall provide a safe installation that complies with legal requirements and applicable standards.

All auxiliaries such as indicators, oil sample points, etc shall be easily readable/accessible, without additional measures to be taken.

The compact stations TR-L0901, TR-00001, TR-00002 and TR-0003 shall consist off at least the following items (see also document S.003843-EF-A435-308_Att_B1):

- Concrete housing with minimum 2 sections;
- One liquid immersed transformer 33/0,41 kV – 400 kVA conform document S.003843-EF-A435-308_Att_E;
- One Low voltage switchgear / distribution board (EATON Halyester, or equivalent make/type) including incoming 3-pole circuit breaker;
- One kWh measurement;
- One main earthing rail, e.g. 5x30mm;
- One feeder for emergency generator supply connection;
- Local emergency lighting;
- Tag number and name plates;
- Socket outlet rack (loose item).

The compact stations TR-Z0901 and TR-Z1001 shall consist off at least the following items (see also document S.003843-EF-A435-308_Att_B3):

- Concrete housing with minimum 2 sections;
- One liquid immersed transformer 33/0,41 kV – 400 kVA conform document S.003843-EF-A435-308_Att_E;
- One Low voltage switchgear / distribution board (EATON Halyester, or equivalent make/type) including incoming 3-pole circuit breaker;
- One kWh measurement;
- One main earthing rail, e.g. 5x30mm;
- One feeder for emergency generator supply connection;
- One feeder key operated for emergency (maintenance) supply connection;
- Local emergency lighting;
- Tag number and name plates;
- Socket outlet rack (loose item).

The walkable enclosure shall consist off at least the following items (see also document S.003843-EF-A435-308_Att_B2):

- Steel container (or equivalent) portable housing with minimum 2 sections;
- Installation of the dry type transformer 33/20 kV – 6,3 MVA (transformer is not part of scope of supply, will be handed over by CLIENT as free issued item for installation)
- Installation of the neutral earthing resistor (neutral earthing resistor is not part of scope of supply, will be handed over by CLIENT as free issued item for installation)
- One 20kV switchgear (EATON Xiria KKT, or equivalent make/type) including incoming 3-pole circuit breaker

- One kWh measurement;
- One main earthing rail, e.g. 5x30mm;
- Roxtec cable transit;
- Local emergency lighting;
- Tag number and name plates;
- Space heaters;
- All auxiliaries such as indicators, etc shall be easily readable/accessible.
-

5.1 Power supply

Power will be supplied from the 33kV switchgear at the existing plant UGS or later (in the final stage) via UHS. Between the 33 kV switchgear and each compact station/walkable enclosure a 33 kV connection will be realized on site by third parties using XLPE 3x120 Cu cable. In the compact stations & walkable enclosure these cables will be inserted and connected by third parties.

The short-circuit capacity at the supply field in question (33kV level) is approximately 1.385 MVA.

In the Netherlands, grids with right and with left rotary fields occur. CLIENT HV and LV installations must be laid out with a right-turn field. When modifications are made to existing CLIENT installations, the rotary field must be checked.

5.2 Earthing

Following design requirements regarding earthing are applicable.

Each compact station and walkable enclosure shall contain one main PE-bar/earthing rail for connecting

- all internal earthing connections;
- the external earthing electrode*;
- 2 free connections for earthing rods
- one earthing ball (suitable for the short circuit current)

*A third party shall connect the local earthing electrode to the PE-bar.

Compact stations

The low-voltage earthing connection between transformer and LSV can be performed with a PEN connection, in the LSV the PEN must be separated into PE and N (system TN-C-S).

Walkable enclosure

The high-voltage earthing connection between transformer and HSV can be performed with a PE connection.

Starpoint of the high voltage transformer (secondary side) shall be resistance grounded (see attachment S.003843-EF-A435-308_Att_B2).

5.3 Separation / protection degrees

Enclosures must have minimum two (2) separate, independently accessible and lockable compartments.

The degree of protection of switchgears / distribution boards (inside the compact station and walkable enclosure) must be at least IP20 when the doors are open and at least IP40 when the doors are closed.

The various compartments of the compact stations and walkable enclosure must be adequately sealed to prevent the entry of rodents (mice, etc.).

Devices to be installed in the field (if any) must have a protection rating of at least IP55. Cable entries must have a protection rating of at least IP54.

Cables will enter the compact stations from the bottom. The foundation plan shall indicate the cable way (e.g. protective pipe) to check bending radius.

For cable entry in the walkable enclosure an MCT frame shall be installed.

The degrees of protection indicated are in accordance with NEN-EN-IEC 60529.

5.4 Safety

The switchgear / distribution board shall be designed in such a way that the safety of staff is not at risk during normal operations, inspections, controlling and/or maintenance.

Fuses shall be capable of being unplugged or installed without either current or voltage (i.e. when system is dead).

For distribution boards, without separate compartments, it shall be possible to provide a lock (LOTO) on the out position of each circuit breaker and outgoing feeder. Within each distribution board, without separate compartment, three locks shall be present.

Regarding arc-flash flash classification the below minimum requirements are applicable:

- 400V switchgear in the compact station shall be tested according criteria 1 t/m 7 of IEC-T-61641;
- 20kV switchgear in the walkable enclosure shall be 20kA/1s FLRA.

5.5 Emergency lighting

One emergency lighting fixture shall be installed in each compartment (containing equipment) of the compact stations and walkable enclosure. This fixture shall contain local battery back-up for 3 hours.

5.6 Socket outlet rack

Next to the compact station, the socket outlet rack shall be installed.

The socket outlet rack for the compact stations TR-L0901, TR-00001, TR-00002 and TR-0003 shall contain as a minimum out of:

- RVS 316 steel rack with provisions for concrete supporting
- 4x socket outlet CEE 125A / 5P / 6h

- 2x socket outlet CEE 63A / 5P / 6h
- 2x socket outlet CEE 32A / 5P / 6h
- Earthing provision

The socket outlet rack for the compact stations TR-Z0901 and TR-Z1001 shall contain as a minimum out of:

- RVS 316 steel rack with provisions for concrete supporting
- 3x socket outlet CEE 125A / 5P / 6h
- 2x socket outlet CEE 63A / 5P / 6h
- 2x socket outlet CEE 32A / 5P / 6h
- Earthing provision

Sockets shall be mounted on a RVS 316 steel frame, bottom of the socket outlet shall be installed 1,2m above ground floor.

Cables between compact station and socket outlets will be installed by a third party.

5.7 Works and construction

All documents required for design, fabrication, installation, maintenance and troubleshooting or for instruments and/or equipment shall be created and provided by the VENDOR.

Components must be arranged and insulated so that they cannot cause injury to people or damage to system components (e.g., electrical lines).

Adequate and sufficient strain reliefs shall be provided for cables to be inserted.

High voltage switchgear (for TR-00005 only) and transformers shall be installed in separate sections/rooms only accessible for qualified personnel based on the high-voltage regime and key plan of the CLIENT

Site work is limited for the VENDOR. It involves the installation of the enclosures and commissioning with adjustment of protective devices. In addition, the necessary tests (SAT) must be carried out. VENDOR must provide support in commissioning the installations.

Throughout the performance of the work at the site, the VENDOR, in close consultation with the management, must cooperate with others who are also required to perform work on site. He must strictly adhere to instructions.

5.8 Civil works

The VENDOR must provide timely drawings for making foundations (sand bed, stelcon plates), and the like. Preferably the compact stations and walkable enclosure shall be installed elevated 500mm to avoid water ingress.

The foundation principle must be indicated already at the time of the quotation.

6. TESTING AND COMMISSIONING

Tests must be performed on the basis of the applicable regulations and this specification. They serve to demonstrate that the system functions reliably and meets the standards and requirements set forth in this document and its appendices.

A test program must be established for the structural completion of both tests. This program must be in CLIENT's possession at least four weeks before the start of the first test. CLIENT reserves the right to extend the test program with additional tests.

A report must be drawn up for each test. The report will include a test of the measurement results against the requirements set by CLIENT.

6.1 Factory Acceptance Test (FAT)

The enclosures must undergo a normal factory test or FAT at the VENDOR's premises in the presence of a CLIENT representative. These are performed on the fully assembled compact station. A report of the tests must be drawn up and shall be submitted to CLIENT.

At least the following checks and tests shall be performed:

- The compact stations & walkable enclosure will be visually inspected. The check shall ensure that the whole unit has been built according to this specification and the last approved drawing.
- The following is checked:
 - the degree of protection of the switchgears / distribution boards;
 - the degree of protection within the compartments;
 - the degree of protection of the main switch and the busbar system;
 - the correct assembly of the components;
 - the internal wiring and cabling;
 - the emergency lighting;
 - the correct text on name plates;
 - the finishing options for the cables or busbars to be connected;
 - the earthing;
 - the correlation of the components in relation to selectivity and resistance to short circuit.
- Insulation measurements.
- High-voltage test (according to IEC 60270)
- Functionality shall also be tested according to the documents and specifications.
- Determination of the tripping current and time for protective devices against overload and short-circuit in conformity with [NEN 3140](#).

6.2 Installation on site/commissioning

Setting up the enclosures at a location to be designated by CLIENT is part of the VENDOR's work. Any civil work (laying sand bed and/or stelcon plates) will be performed by third parties.

After all installation and connection work (by third parties and by the VENDOR) has been completed, the system must be put into operation by the VENDOR together with a representative of CLIENT.

The VENDOR must make the installations ready for operation on site. It is part of VENDOR's work to configure and set up all equipment as necessary. It also includes entering and sealing the protection settings of the

circuit breakers. The basic protection settings are shown on attachments B1 and B2.

6.3 Site Acceptance Test (SAT)

After installation on site / commissioning, the fitted enclosures must undergo a test or SAT to demonstrate the functionality of the various components. This is carried out by the VENDOR in the presence of a representative of CLIENT. During these tests, at least the insulation resistance measurements are repeated before live operation.

The SAT tests involves:

- Checking whether the busbar system bolts have been tightened according to the VENDOR's specifications;
- Repeating the insulation measurements and high-voltage tests.
- Test sheets to be handed over to CLIENT.

6.4 Instruction

Separate from commissioning, the VENDOR shall provide on-site instruction for operation and maintenance to operating maintenance personnel. The date of the instruction must be mutually agreed upon at least fourteen days prior to commissioning.

7. INFORMATION TO BE SUBMITTED BY VENDOR

The offer shall contain the following information, set out in the order below, possibly referring to appended documentation:

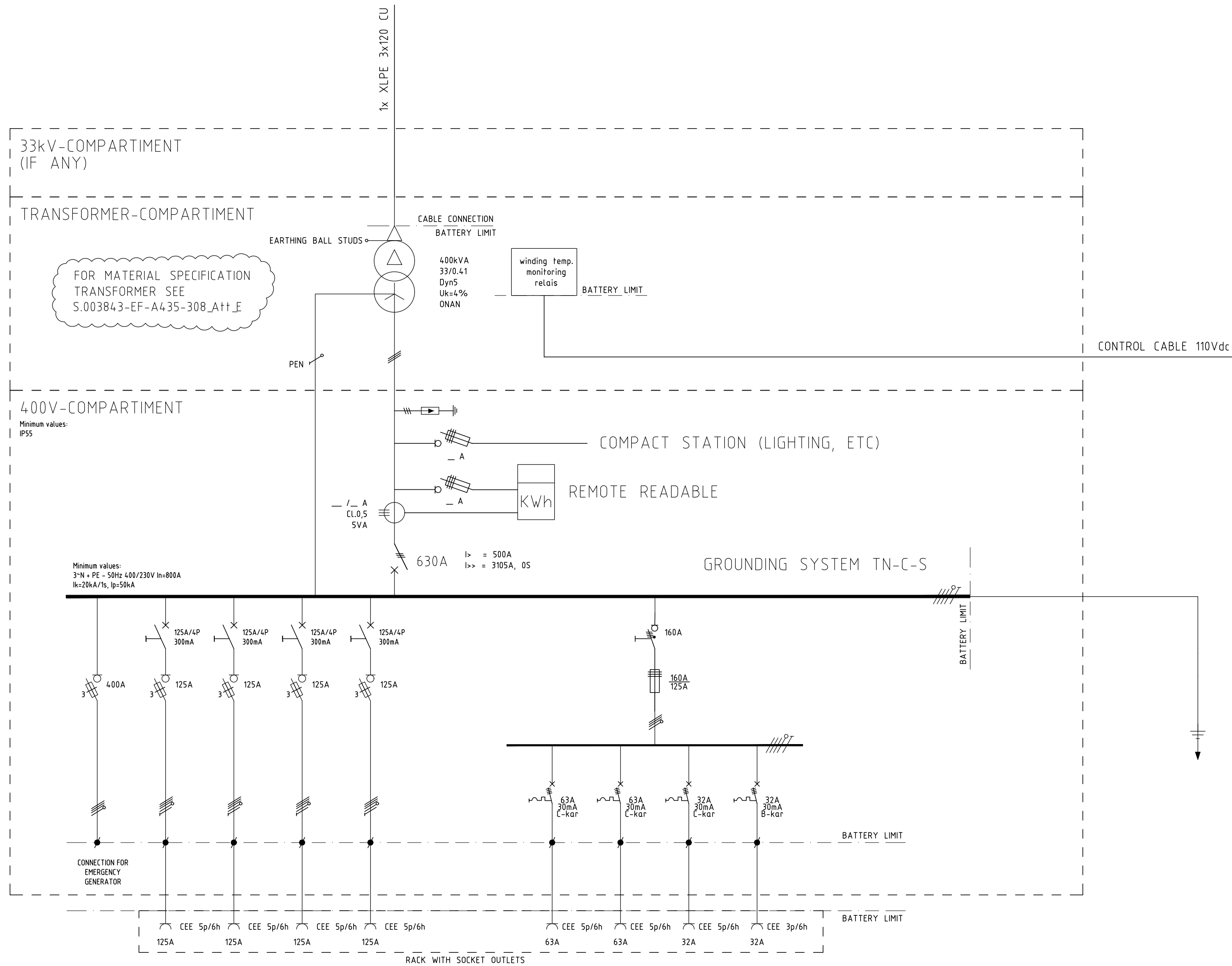
- a point-by-point summary of all the areas where the offer deviates from this specification and related documents;
- a detailed description of the installations with a specification of the components with, where applicable, a note of manufacturers, types, materials, dimensions, weights and the like;
- if available, information of the arc flash protection within the switchgears. Including type test reports;
- the proposed colour per equipment item;
- the necessary structural facilities that have to be provided, where possible these shall be shown on the drawing;
- an elevation and/or layout drawing with dimensions and weight;
- reference is also made to the RED form attached.

8. Transportation and installation on site

The following specifications are applicable for:

- transportation [MSA-25-E](#);
- storage [MSA-23-N](#);
- safety requirements during installation on site [CSA-38-E](#).

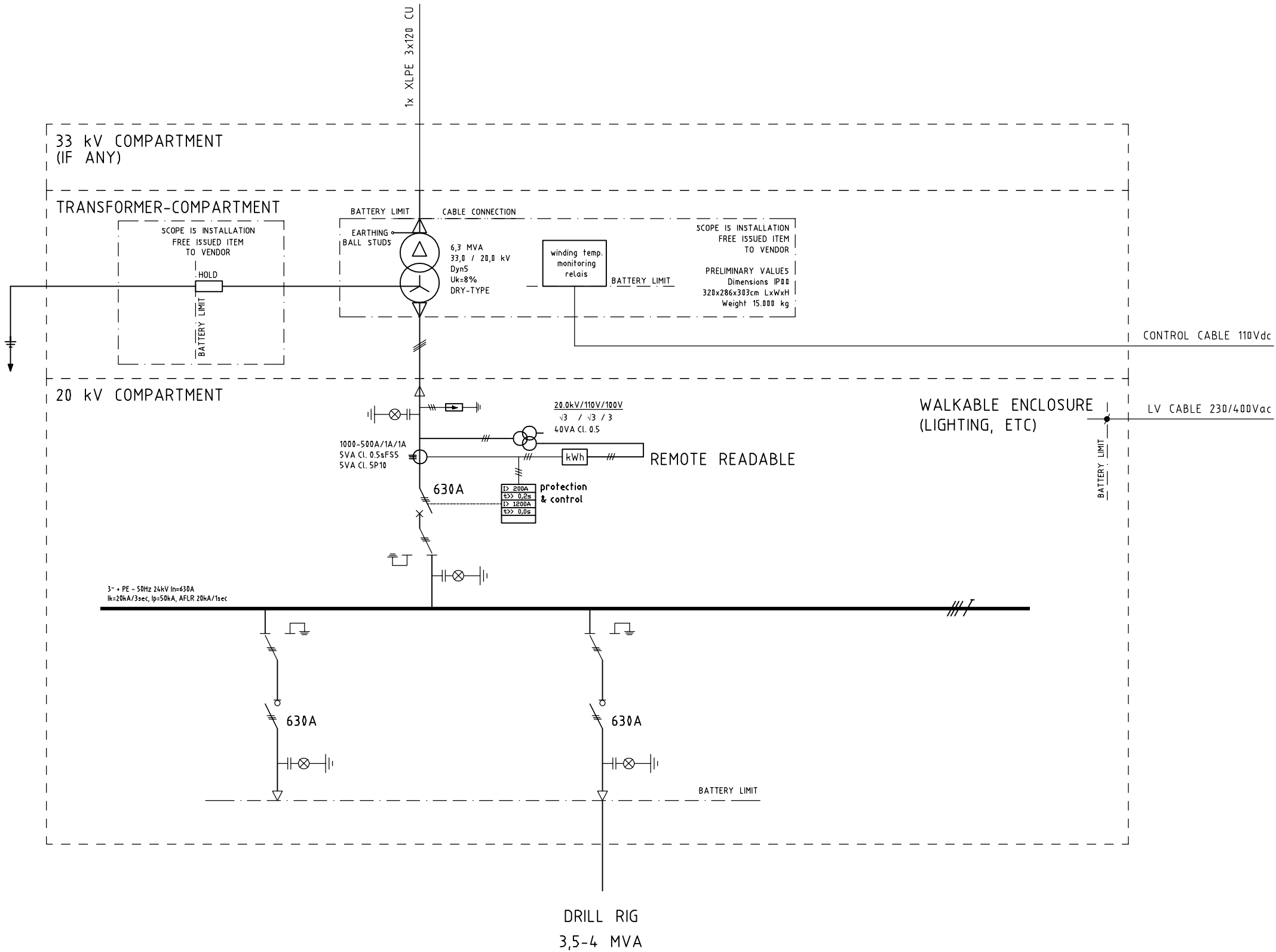
TEK. NR. 1:



TYPICAL FOR:
TR-0001
TR-0002
TR-0003
TR-L0901

TITEL										
TYPICAL 1 COMPACT STATION 400 kVA FOR CONSTRUCTION POWER										
STATUS		GETEKEND DOOR N. Alp		AFD. TEBODIN	PAR.	© 2020 N.V. NEDERLANDSE GASUNIE				
		GECONTROLEERD DOOR R. Ottes		AFD. TEBODIN	PAR.	OMSCHRIJVING WIJZIGING			GETEKEND BIJ TEBODIN B.V.	
		VOOR AKKOORD J. HOEFSMIT		AFD. GASUNIE	PAR.	SCHAAL - / -		DATUM 1e UITGAVE 28-03-2025	DATUM WIJZIGING	
	CATEGORIE C	VAKGEBIED 05	TEK. SOORT 30	PROJECT NR. -	FORMAAT	NUMMER				WIJZ. NR.
	BEHEER & ONDERHOUD NEE		SUBLOCATIE/GEBOUW CODE -		A3	S.003843-EF-A435-308_Att_B1				B

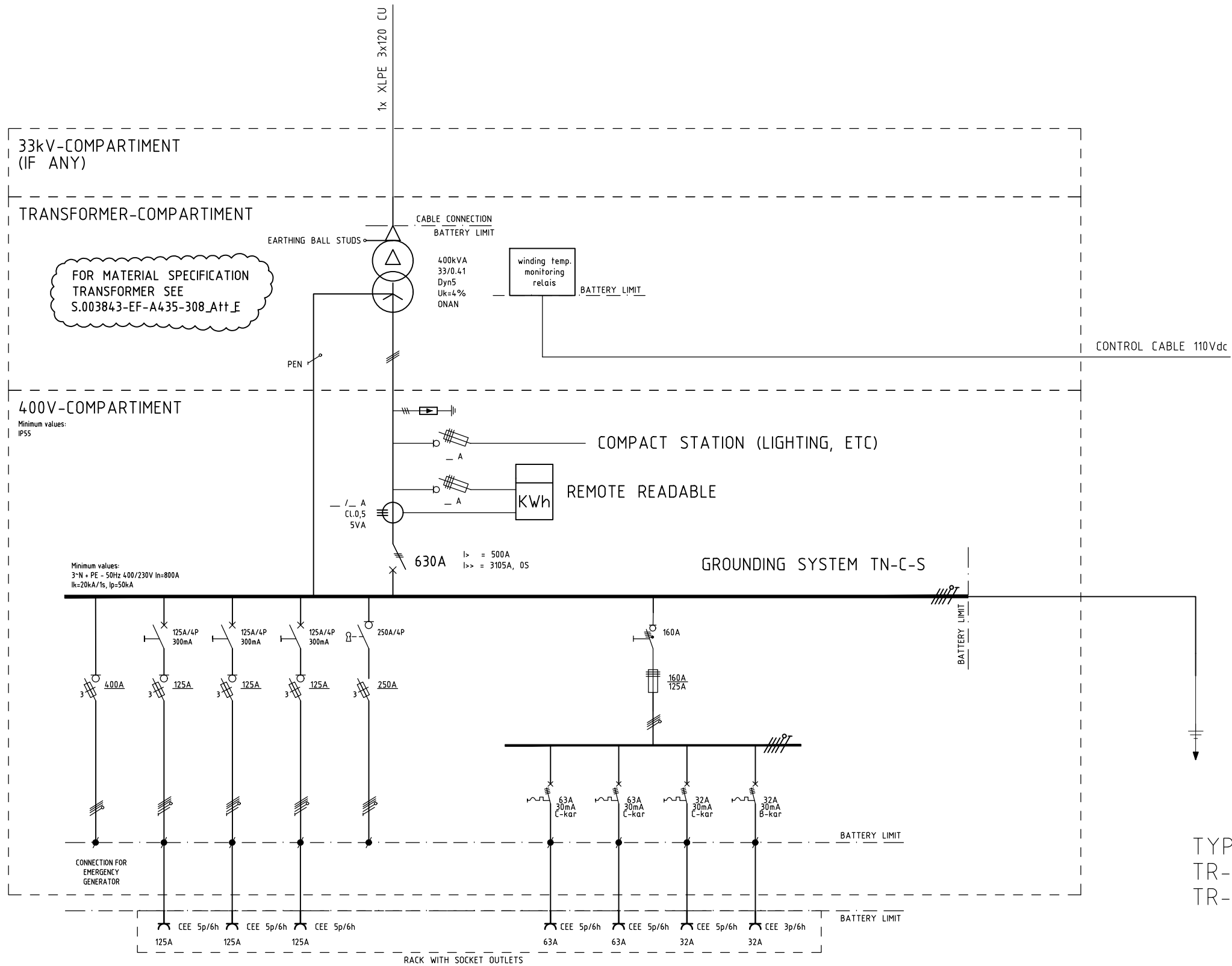
TEK. NR.:



TEMPORARILY SUPPLY UNIT

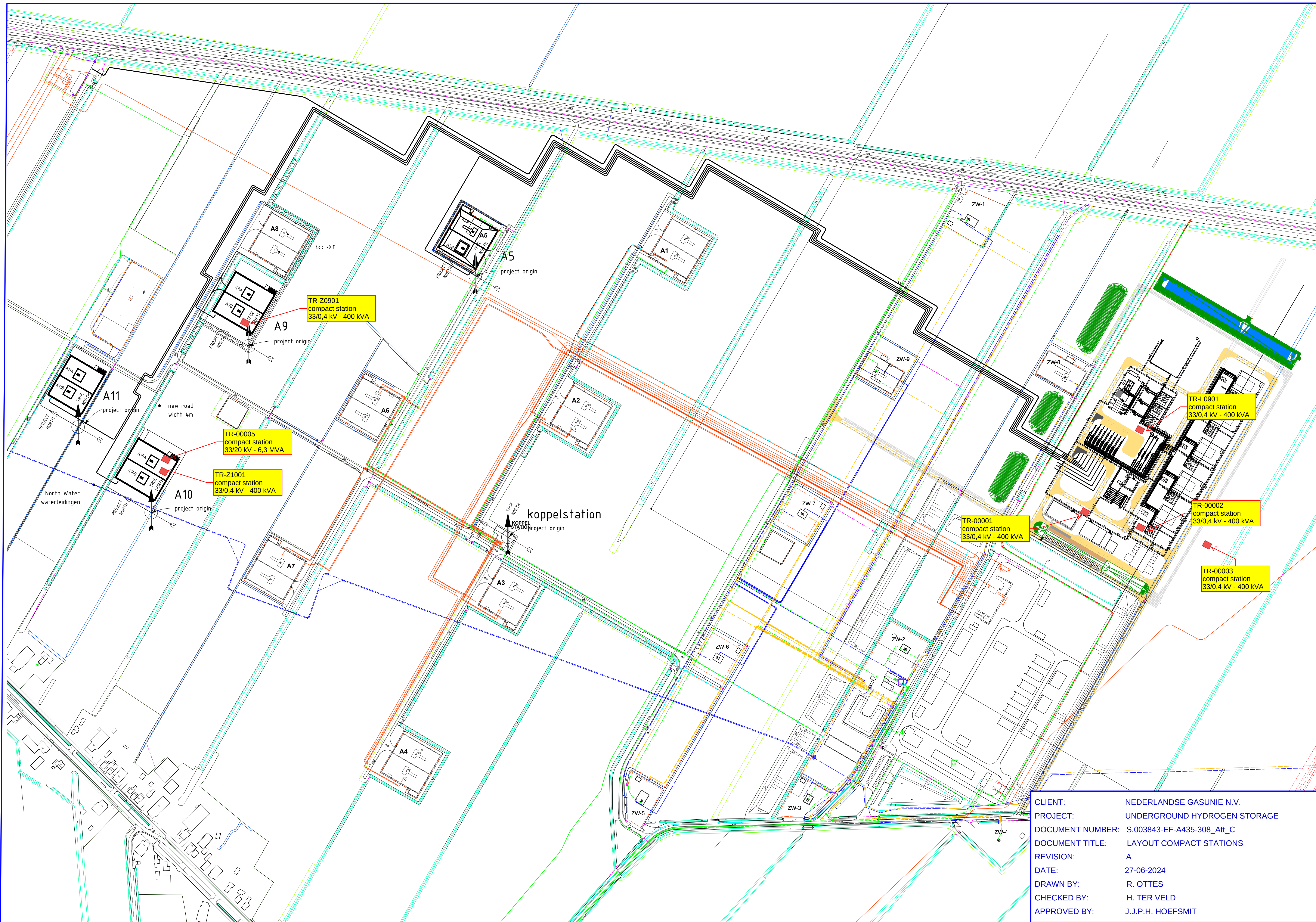
TITEL TYPICAL WALKABLE ENCLOSURE 6,3 MVA FOR DRILLING									
STATUS	GETEKEND DOOR	N. Alp	AFD.	TEBODIN	PAR.	© 2020 N.V. NEDERLANDSE GASUNIE			
	GECONTROLEERD DOOR	R. Ottes	AFD.	TEBODIN	PAR.	OMSCHRIJVING WIJZIGING		GETEKEND BIJ TEBODIN B.V.	
	VOOR AKKOORD	J. Hoefsmijt	AFD.	GASUNIE	PAR.	SCHAAL	DATUM 1e UITGAVE	DATUM WIJZIGING	
		- / -					27-06-2024		
gasunie	CATEGORIE	VAKGEBIED	TEK. SOORT	PROJECT NR.	FORMAAT	NUMMER			WIJZ. NR.
	BEHEER & ONDERHOUD NEE	05	30	-	A3	S.003843-EF-A435-308_A11_B2			A

TEK. NR.:



TYPICAL FOR:
TR-Z0901
TR-Z1001

TITEL										
TYPICAL 2 COMPACT STATION 400 kVA FOR CONSTRUCTION POWER										
STATUS		GETEKEND DOOR N. Alp		AFD. TEBODIN	PAR.	© 2020 N.V. NEDERLANDSE GASUNIE				
		GECONTROLEERD DOOR R. Ottes		AFD. TEBODIN	PAR.	OMSCHRIJVING WIJZIGING			GETEKEND BIJ TEBODIN B.V.	
		VOOR AKKOORD J. HOEFESMIT		AFD. GASUNIE	PAR.	SCHAAL - / -		DATUM 1e UITGAVE 28-03-2025	DATUM WIJZIGING	
	CATEGORIE C	VAKGEBIED 05	TEK. SOORT 30	PROJECT NR. -	FORMAAT	NUMMER				WIJZ. NR.
	BEHEER & ONDERHOUD NEE		SUBLOCATIE/GEBOUW CODE -		A3	S.003843-EF-A435-308_A11_B3				A



CLIENT:	NEDERLANDSE GASUNIE N.V.
PROJECT:	UNDERGROUND HYDROGEN STORAGE
DOCUMENT NUMBER:	S.003843-EF-A435-308_At_C
DOCUMENT TITLE:	LAYOUT COMPACT STATIONS
REVISION:	A
DATE:	27-06-2024
DRAWN BY:	R. OTTES
CHECKED BY:	H. TER VELD
APPROVED BY:	J.J.P.H. HOEFSMIT

REQUIREMENTS FOR DOCUMENTS (RED) COMPACT STATIONS & WALKABLE ENCLOSURE	Specification no.: S.003843-EF-A435-308_Att_D	
	Related to: Underground Hydrogen Storage	
	UHS - HyStock 27-06-2024	
Page 1 of 2		Rev.: A

Legend:
 P = Number of prints
 DF = Digital file in PDF format
 W/O = Required number of weeks after purchase order issue¹⁾
 W/A = Required number of weeks after release by Gasunie Inspection²⁾

TYPE OF DOCUMENTS	REQUIRED							FOR NOTES, SEE PAGE 2
	Inquiry	For approval ¹³⁾			Final			
	DF	P	DF	W/O	P	DF	W/A	
A GENERAL DOCUMENTS								
A1 General arrangement drawings	☒		☒	4		☒	2	
A2 Manufacturing Data Book	☐		☐			☒	2	
A3 Planning schedule	☒		☒	4		☐		
B ENGINEERING DOCUMENTS (Mech./Civil)								
B1 Construction drawings	☒		☒	4		☒	2	
B2 Material parts list	☐		☐			☒	2	
B3 Dimensional drawings and weight data for handling	☐		☒	4		☒	2	
B4 Design calculations	☐		☐			☐		
B5 Thermal design calculations	☐		☐			☐		
B6 Completed data sheets	☐		☐			☐		
B7 Data/curves	☐		☐			☐		
B8 Test data/curves	☐		☐			☐		
B9 Noise limitation data sheet	☐		☐			☐		
B10 Vibration analysis	☐		☐			☐		
B11 Hazard analyses	☐		☐			☐		
C ENGINEERING DOCUMENTS (E&I)								
C1 Logic diagram/functional diagram	☐		☐			☐		
C2 Wiring diagrams	☐		☒	4		☒	2	
C3 Loop diagrams	☐		☐			☐		
C4 Connection diagrams	☐		☒	4		☒	2	
C5 EMC test proposal	☐		☒	4		☒	2	
C6 EMC test report	☐		☒	4		☒	2	
C7 ATEX explosion-proof certificates	☐		☐			☐		
C8 Software documentation	☐		☐			☐		
C9 Single line diagrams	☐		☒	4		☒	2	
D OPERATING DOCUMENTS								
D1 Installation instructions	☐		☒	4		☒	2	
D2 Operating manual	☐		☐			☒	2	
D3 Maintenance manual	☐		☐			☒	2	
D4 Spare parts list	☐		☒	4		☒	2	
E INSPECTION AND TEST DOCUMENTS								
E1 Inspection and Test Plan (ITP) ⁴⁾	☐		☒	4		☐		
E2 Test reports	☐		☐			☒	3	

GENERAL NOTES TO REQUIREMENTS FOR DOCUMENTS (RED)

Specification no.: S.003843-EF-A435-308_Att_D

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Rev.: A

General:

- a. All documents required for inquiry shall be submitted with the quotation to Gasunie's Procurement Department.
- b. All documents shall be submitted to Gasunie with a properly addressed transmittal form (GTS_REQ-003 and GTS_REQ-004) for the attention of the department as specified.
- c. Any deviations from the timing for submission of documents shall be notified to Gasunie's Procurement Department by letter or e-mail.
- d. Each document shall bear the item or tag number and the Gasunie purchase order number and shall be dispatched in time to meet the required dates as specified in the purchase order.
- e. All documents should preferably be in Dutch. English may be used as an alternative.
- f. Dimensions used on engineering documents shall be in SI units. Nominal pipe sizes may also be indicated in imperial units between brackets.
- g. The following standard sizes shall be used: A4, A3, A2 and A1.
- h. Drawings consisting of five or more pages shall be treated as a package. A package shall include a front page, an index page and a revision page. The lay-out of these pages shall be submitted to the supplier by Gasunie's engineer.
- i. Data sheets are to be completed if applicable.

Notes:

- 1) Lead time for Gasunie approval is 10 working days. Shop fabrication shall not be started before the required engineering documents have been released for construction (A- or B-approved) by Gasunie.
- 2) Release note will be submitted after Manufacturing Data Book has been uploaded on Qdocs.
- 3) Documents such as drawings, calculations and the like that already have been approved by Gasunie are not required for resubmission for approval in the case of the following Purchase Order(s).
- 4) Approval on major aspects. Final approval during Pre Inspection Meeting after engineering documents have been "released for construction".

Manufacturing Data Book:

Contents:

- A. General documents
- B. Engineering documents (Mechanical)
- C. Engineering documents (E&I)
- D. Operating documents
- E. Inspection and test documents*

* E1 Approved ITP followed by documents as mentioned in the ITP.

MATERIAL SPECIFICATION

Specification no.: VBS-09-E

Version : 3

Date : 27-06-2020

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DISTRIBUTION TRANSFORMERS**Zuidwending UHS A-435****Document:****S.003843-EF-A435-308_Att_E**

NAME	INITIALS	DEPT.	DATE
(Made by) R. Ottes	ROTS	Bilfinger-Tebodin	27-06-2024
(Checked by) H. ter Veld	HVLD	Bilfinger-Tebodin	27-06-2024
(Approved by) J.J.P.H. Hoefsmit	JHOT	Gasunie	27-06-2024

Department : Electrical
Project no. : S-003843
Location no. : A-435
Location name : Zuidwending

[illegible]

FOREWORD

This specification supersedes the second version of VBS-09-E.

With respect to the former version the following has been changed:

- added subclause 6.4 "Phase connection, cable boxes";
primary and secondary connection shall be foreseen with cable box
- deleted subclauses 5.13 ("Bus bar") and 7.4 ("Phase connection, cable boxes"); these subclauses are incorporated in the new added subclause 6.4 "Phase connection, cable boxes".

This specification is drawn up by the Gasunie department "Operations; Technology - E&I Installations".

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1. SCOPE AND APPLICATION

1.1 Scope

This specification provides the minimal technical requirements for the design, fabrication, assembly, testing, delivery and on site erection of distribution transformers in the range of approximately 100 kVA - 2500 kVA.

Connection of cabling or bus bars is not part of the scope of this material specification.

1.2 Application

This specification is applicable for distribution transformers made for Gasunie. Within Gasunie two types of distribution transformers are distinguished:

- Liquid-immersed three-phase power transformers with separate windings;
- Dry-type three-phase power transformers with separate windings.

This specification covers both types, additional requirements for both types are laid out in clause 7 (liquid-immersed) and in clause 8 (dry-type).

2. REFERENCES

This specification is subject to the requirements of the documents mentioned in this clause.

If the documents in this specification are mentioned with a date, this specific edition is applicable.

2.1 Gasunie specifications

Reference is made in this specification to the following Gasunie specifications:

CSA-38-E	Safety, health and environmental management at construction sites (bilingual document).
MSA-23-N	Handling, opslag en kwaliteitsbewaking van materialen (Handling, storage and quality inspection of materials).
MSA-24-N	Tag-nummer- en naamplaten (Tag number and name plates).
MSA-25-E	Transport, packing and marking.
MSW-11-E	Shop coating of steel structures and pipeline elements.
GTS REQ-003	Engineering and operating documents transmittal.
GTS REQ-004	Test and inspection documents transmittal.

2.2 Standards

Reference is made in this specification to the standards¹ mentioned in this subclause. Any supplements and errata notices are also applicable.

IEC 60076-7	Power transformers – Part 7: Loading guide for mineral-oil-immersed power transformers.
IEC/IEEE 60214-2	Tap-changers – Part 2: Application guidelines.
IEC 60654-1	Industrial-process measurement and control equipment; operating conditions; part 1: climatic conditions.
NEN-EN-IEC 60076-1	Power transformers – Part 1: General.
NEN-EN-IEC 60076-2	Power transformers – Part 2: Temperature rise for liquid-immersed transformers.
NEN-EN-IEC 60076-3	Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air.
NEN-EN-IEC 60076-5	Power transformers – Part 5: Ability to withstand short circuit.
NEN-EN-IEC 60076-10	Power transformers – Part 10: Determination of sound levels.
NEN-EN-IEC 60076-11	Power transformers – Part 11: Dry-type transformers.

¹ Applicable for all NEN-EN standards: Depending on the country where the standard will be applied, DIN-EN or BS EN, for example, shall be chosen.

NEN-EN-IEC 60076-18	Power transformers – Part 18: Measurement of frequency response.
NEN-EN-IEC 60214-1	Tap-changers – Part 1: Performance requirements and test methods.
NEN-EN-IEC 60270	High/voltage test techniques / Partial discharge measurements.
NEN-EN-IEC 60296	Fluids for electrotechnical applications – unused mineral insulating oils for transformers and switchgear.
NEN-EN-IEC 60529	Degrees of protection provided by enclosures (IP Code).
NEN-EN-IEC 61099	Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes.

2.3 Legislation

Reference is made in this specification to the following government regulations:

2009/125/EC	Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.
548/2014	Commission Regulation (EU) No 548/2014 of 21 May 2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers.

3. DEFINITIONS, ABBREVIATIONS AND SYMBOL

3.1 Definitions

In this specification the following definitions are applicable:

AISI 316	Stainless steel, grade 316
Client	The person or persons who is/are responsible, on behalf of Gasunie, for supervising the fulfillment of the contract in general and the execution of the work in particular.
DGPT2	Type of protection relais. Discharged Gasses, Pressure, 2 Temperature contacts.
Primary winding	The winding which receives active power from the supply source in service is referred to as the primary winding.
Secondary winding	The winding which delivers active power to a load is referred to as the secondary winding.
Service provider	The party with whom the contract is or will be concluded.

3.2 Abbreviations

In this specification the following abbreviations are applicable:

EMC	Electromagnetic compatibility
FAT	Factory Acceptance Test
KNAN	K (Synthetic or natural ester oil, flash point > 300 °C)
	Natural Air Natural
MSDS	Materials Safety Data Sheet
ONAN	Oil Natural Air Natural
PCB	Polychloorbifenyyl
PVC	Poly Vinyl Chloride
RED	Required Engineering Documents
SAT	Site Acceptance Test
THD	Total Harmonic Distortion
XLPE	Crosslinked Polyethylene

3.3 Symbol

In this specification the following symbol is applicable:

<u>Symbol</u>	<u>Description</u>	<u>Unit</u>
U_k	short circuit impedance	%

4. REQUIREMENTS FOR INQUIRY AND QUOTATION

The quotation shall include an extensive description of the transformer and auxiliary items and shall be written in English.

The data sheet in annex B shall be completed by the service provider.

Any conflict between the requirements of this specification and related codes, standards, data sheets, drawings and the like shall be referred to client for clarification.

Assumptions to cover lack of information are not allowed. Supplier is obliged to obtain reliable information from client.

Service provider shall submit a list of all appliances, special tools and accessories that are necessary for the proper installation, operation and maintenance of the equipment, even though these items are not included on the drawings, specifications or data sheets.

Supplier shall fully describe all deviations from this specification, data sheets and the related codes.

4.1 Price

The proposal shall include the total project price and, in addition, separate prices for the following items:

- unit;
- delivery and erection on site;
- the total testing as described in this specification (FAT and SAT);
- documentation.

4.2 Scope of supply

Service provider shall design, manufacture and deliver materials in accordance with this specification and with the attached data sheets.

Service provider shall furnish all drawings and documents mentioned in the RED (Required Engineering Documents) form which can be found in annex C.

All labour and materials necessary to complete the delivery of a fully functional transformer are to be furnished by service provider.

4.3 Planning schedule

The supplier is to provide, as part of his proposal, a planning of the project. The planning shall show all significant events such as engineering, fabrication, erection, testing and delivery.

5. DESIGN REQUIREMENTS

5.1 Compliance

The transformer shall comply with ([NEN-EN-IEC 60076 part 1](#), [part 2](#), [part 3](#), [part 5](#), [part 7](#), [part 10](#), [Directive 2009/125/EC](#), Regulation [548/2014](#) and all other standards mentioned in this specification.

5.2 Loading conditions

The transformer shall be capable of continuous operation at the given maximum rated power. The expected average load factor is stated on the data sheet in annex A.

If any harmonic load is connected to the transformer this will be specified on the data sheet. The transformer shall still be capable to give continuous maximum rated power.

5.3 Losses

Service provider shall propose a transformer which is constructed to have the most efficient loss figures for the specified type and size of transformer.

Service provider shall document the proposal with guaranteed values regarding load and no load losses. The capitalised values are stated on the data sheet in annex A.

No positive tolerance on the guaranteed maximum load and no load losses is allowed.

5.4 Sound emission

The sound power level (re. 10^{-12} Watt) of the transformer shall not exceed the given value on the data sheet in annex A. The noise level has an upper tolerance of + 0 dB. Determination of sound level shall be according to [NEN-EN-IEC 60076-10](#).

After installation, a third party measurement in assignment of client will be taken to check if the sound emission is within the specified range.

5.5 Environmental conditions

The transformer shall be suitable to operate in conditions according to the classes prescribed in [IEC 60654-1](#), stated on the data sheet in annex A.

5.6 Safety and reliability

The transformer shall be of a standard, well tested and proven design which ensures maximum safety to personnel, maximum service reliability and economic operation for an operational lifetime of at least 30 years. Design and construction shall be simple and shall provide good accessibility to components and parts.

5.7 Fire safety

With all materials to be used, and especially in case of liquid immersed transformers, special attention shall be given to reduce the risk of fire.

Service provider shall provide information to client about the potential risks and the methods that have been applied to reduce these risks to a minimum.

5.8 Materials

All system parts shall be capable of continuous operation at their maximum ratings and within their limits of temperature rise as stated in the data sheet.

All equipment, materials and parts shall be brand-new and unused, of current manufacture, of modern design and of the highest industrial grade, free from imperfections that might affect the performance.

PCB synthetic liquids or other chlorinated hydrocarbons, are not acceptable and shall not be used.

5.9 EMC

According to [NEN-EN-IEC 60076-1](#) power transformers shall be considered as passive elements in respect to emission of, and immunity to, electromagnetic disturbances.

5.10 Cooling

The proposed transformer shall be of a non-active cooling type.

5.11 Parallel operation

Should the transformer be required to operate in parallel with existing transformer(s), the necessary information of the existing transformer to ensure successful parallel operation is included in the data sheet.

Tolerances for short circuit impedance, required for parallel operation, are given on the data sheet in annex A.

5.12 Clearance distances

The minimum clearance distances for phase-to earth, phase-to-phase, phase-to-neutral and to lower voltage windings from bushings live parts on the transformer shall comply with [NEN-EN-IEC 60076-3](#).

5.13 Local indicators

Any local indicator of temperature, oil level and the like shall be easily visible from ground level.

6. CONSTRUCTION REQUIREMENTS

6.1 Transformer core

Transformer core shall be of robust design, adequately braced to prevent displacement due to:

- electromagnetic stresses or short circuits, and
- the mechanical shocks of normal moving, and
- handling of the transformer without any need for special shipping braces.

The core laminations shall be evenly secured to prevent settling of the core and minimize noise and vibration when transformer is in operation. The core construction shall be such that removal and replacement of the coils would require the removal of minimal possible number of core laminations (to be specified by service provider).

6.2 Transformer winding

Transformers shall have separate low and high voltage windings.

All windings shall be fully insulated and the insulation shall be free from any composites likely to soften, shunt or collapse during service.

The insulating material shall be of a type that does not shrink, disintegrate, carbonize or become brittle in hot oil. Insulation varnish treatment shall be accomplished by vacuum impregnation.

Windings shall be adequately braced to prevent displacement due to electromagnetic stresses or short circuits, and the mechanical shocks of normal moving and handling of the transformer.

The neutral point of star connected windings shall be brought out separately to a terminal on the respective winding side.

6.3 Terminals

To provide a 4-wire system, the star point connection shall be available as a single connection point.

Terminals shall be marked in accordance with the connection diagram marked on the rating plate.

External terminals for the connection of cables shall be provided with bolted type conductor connections of adequate dimensions and ratings and if two or more conductors per terminal are required, provisions shall be made to achieve this.

Primary as well as secondary connections of the transformer shall be provided with fixed ball points of 20 mm for the connection of an earthing and short-circuiting device in case of maintenance activities.

6.4 Phase connection, cable boxes

An air insulated cable box is required for the connection of the primary, secondary and neutral point wiring. This will be suitable for entrance of the cables from below or a bus bar system from above. The cable box shall be suitable for outdoor conditions.

If a bus bar connection is required (data sheet annex A), client will supply the necessary information to service provider to design and construct this connection.

The clearance distance between the active parts and the cable box construction/casing shall be designed according to [NEN-EN-IEC 60076-3](#).

Cable entries into these box(es) shall be located such that conductors can be connected straight to the applicable terminal connector without being bent into tortuous shapes inside the box. Therefore extension pieces bolted to the actual terminal in line with the cable entry may be required. Dimensions of the cable entry boxes shall be suitable for standard cable connection systems.

Cable boxes for PVC or XLPE cables shall be air insulated. Single core cables shall be mounted in non-magnetic gland plates. These gland plates including compression type glands are part of the delivery.

For star point earthing an extra gland, suitable for insulated cable shall be provided. In case of the use of a (an unventilated) cable box, service provider shall use high temperature gaskets for the bushings located in the cable box.

6.5 Junction boxes

Service provider shall use junction boxes of AISI 316 grade steel for connection of all auxiliary equipment. Junction boxes shall be equipped with the specified number of glands as mentioned on the data sheet in annex A.

6.6 Earthing

Parts like metal frames (skid), metallic cable boxes and enclosures shall be provided with external earthing terminals. This shall be either a threaded bolt or bolted clamp suitable for the connection of a stranded copper earthing cable max. 185 mm².

For safety earthing purposes the primary and secondary connection shall be provided with earthing ballpins (electro-tinned copper), ball size align with fault rating.

6.7 Transport fittings and accessories

Transformer shall be provided with the following fittings and accessories:

- lifting lugs for lifting the entire transformer;
- hauling lugs for positioning the transformer;
- skid under base with bi-directional rollers (removable);
- If reversible skid rollers are used, suitable blocking facilities shall be included in the delivery.
- rating plate, AISI grade 316;

- any special tools required for erection, operation, or maintenance of the transformer.

A shock recorder shall be installed during transport and reports shall be hand over to client directly after unloading.

6.8 Name plate

The nameplate with the tag number shall be of a slide frame type, consisting of the characters and digits corresponding with the listed tag on the data sheet in annex A.

All name plates shall be supplied with an AISI 316 mounting plate.

Lettering height shall be 100 mm. Further name plate requirements are mentioned in [MSA-24-N](#).

6.9 Rating plate

The rating plate(s) shall be of AISI grade 316. The rating plate(s) shall give the information as prescribed in [NEN-EN-IEC 60076-1](#) in English, including:

- the international standard(s) to which the transformer conforms to;
- vector group and winding connection;
- percentage tapping positions of rated voltage;
- rated voltage at zero tapping;
- rated LV voltages at no load and full load at above condition;
- rated kVA;
- rated full load current and short circuit current withstand with defined time;
- rated reactance;
- manufacturer, type, volume, and weight of insulation liquid (in case of liquid immersed transformer);
- enclosure class of transformer;
- lifting weight of the entire transformer with and without liquid;
- transformer type, manufacturer, serial number, year of manufacture and purchase order number (Gasunie order number).

7. ADDITIONAL REQUIREMENTS FOR LIQUID-IMMERSED TRANSFORMERS

7.1 Transformer tank

Liquid immersed transformers are preferred to be of an hermetically sealed type. The tank, cover, radiators and any other attached compartments, shall be of rigid steel construction. Radiator tubes or fins shall be arranged in such a way that external cleaning and repainting can be carried out at site without dismantling.

The tank cover shall be bolted or welded with continuous joint. After filling the tank with oil, the filling orifice shall be permanently sealed in a tamperproof manner.

All bushings shall be self-contained and shall be sealed into the enclosure air/gas and liquid tight with non-deteriorating gaskets suitable for the liquid used.

7.2 Liquid filling

Liquids shall be transformer oils complying [NEN-EN-IEC 60296](#). Oil shall be dried prior to filling of the transformer which shall be performed under vacuum. The dielectric strength of the oil shall be more than 125 kV/cm. The transformers shall be filled with oil at the manufacturer's works. The brand and type of oil shall be stated on the rating plate and on a separate plate near the filling point.

If stated on the data sheet service provider shall (as an alternative) propose the optional use of a synthetic organic ester fluid complying with [NEN-EN-IEC 61099](#). A comparison of conventional mineral oil and the suggested organic ester fluid shall be submitted for approval to client, with information regarding at least the following items:

- durability;
- fire safety/fire point;
- any performance limitations;
- environmental facts and figures;
- maintenance intervals;
- price quotation.

7.3 Conservator

Transformers equipped with a conservator shall comply with the following:

- The conservator shall be of such size that it withstands the changes in oil volume within the temperature range of -20 °C to +40 °C under full load conditions.
- An oil level indicator shall be placed on the conservator which can be easily read from ground level.
- A dehydrating air breather of a low maintenance type shall be attached to the conservator, which shall be easily accessible and maintainable from ground level.

7.4 Fittings and accessories

The transformer shall be provided with the following fittings and accessories:

- drain plug(s) where necessary to drain the equipment completely;
- filling cap for topping off liquid;
- access point to take oil samples.

7.5 Protection devices

The transformer shall be equipped with a DGPT2 protection device. For specific requirements reference is made to the data sheet.

The protection device DGPT2 (standard type) shall provide protection against:

- discharges of gasses;
- tank internal over pressure;
- dielectric fluid temperature at two different thresholds.

DGPT2 shall provide also indication of:

- compensated dielectric fluid temperature;
- dielectric fluid level;
- indicator of oil temperature.

The standard DGPT2 shall be fitted with oil thermometer, with local indicator and maximum needle.

If the transformer could not be equipped with this type of device, an equivalent level of protection should be achieved and will be put to client's approval in the offer.

7.6 Tap changer

Tap changing on the winding tapping positions shall be done with an externally hand operated off-load tap changing switch, which shall comply to NEN-EN-IEC 60214 [part 1](#) and IEC/IEEE 60214 [part 2](#). The switch shall satisfy the following requirements:

- the switch shall be operable by its handle without the need of additional tool and without risk to personnel safety;
- the contact changing shall be a positive snap action, arranged in such a way that it is impossible for the contacts to be left in a position where the circuit remains interrupted;
- the stops shall be of a robust type to prevent overrunning;
- padlocking of the switch shall be provided;
- tap positions shall be clearly marked;
- the driving rod through the tank cover or wall shall be sealed to prevent leakage of air, gas or liquid under all service conditions.

The tapping range and number of positions are stated on the data sheet.

8. ADDITIONAL REQUIREMENTS FOR DRY-TYPE TRANSFORMERS

8.1 Construction requirements

Dry type transformers shall be cast coil model and shall comply to [NEN-EN-IEC 60076-11](#).

8.2 Enclosure

The transformer shall be either without an enclosure (indoor placement) or supplied in an IP54 (according to [NEN-EN-IEC 60529](#)) enclosure when placed outdoor.

The enclosure shall be of robust construction and shall have either bolted covers or padlocked doors. Precautions shall be taken to prevent or limit the harmful effects of condensation.

Earthing connection facilities shall be included to the enclosure, making use of M8 bolting connections. All covers, doors and other bolted parts shall be connected to earth.

8.3 Protection devices

The transformer windings shall be fitted with winding temperature sensing indicators using PT100 sensors. The sensors should be located in positions that most closely indicate the hot spot temperature of each winding. If specified on the data sheet sensors/indicators shall have alarm set points (pre-alarm and tripping contact).

8.4 Tap changing

Tap changing on dry type transformers shall be done by means of bolted links.

9. INSPECTION AND TESTING

9.1 Hold and witness points

If representation of client by engineer and/or inspector is desirable during the manufacturing or testing period, this will be stated on the data sheet or accompanying documentation.

Manufacturer shall inform client two weeks prior to the testing dates. If there are any tests to be done at the Gasunie site, manufacturer shall submit a proposal of the execution of these test.

9.2 Routine testing

The transformer shall be subjected to the following test procedures:

- winding resistance measurement (according to [NEN-EN-IEC 60076-1](#));
- measurement of voltage ratio and phase displacement (according to [NEN-EN-IEC 60076-1](#));
- measurement of short circuit impedance (according to [NEN-EN-IEC 60076-1](#));
- measurement of load loss (according to [NEN-EN-IEC 60076-1](#));
- measurement of no load loss and current (according to [NEN-EN-IEC 60076-1](#));
- dielectric routing test (according to [NEN-EN-IEC 60076-3](#));
- operational test of tap changer (according to [NEN-EN-IEC 60076-1](#));
- for oil-immersed transformers leak/tightness test (according to [NEN-EN-IEC 60076-1](#));
- partial discharge test (according to [NEN-EN-IEC 60270](#)).

9.3 Typetest

On request the reports of the following type tests, (carried out on a similar transformer) shall be hand over:

- temperature rise test (according to [NEN-EN-IEC 60076-2](#));
- short circuit withstand test (according to [NEN-EN-IEC 60076-3](#));

If requested on the data sheet the manufacturer shall carry out the temperature rise test (according to [NEN-EN-IEC 60076-2](#)) on the specific transformer.

9.4 Special testing

If requested on the data sheet the manufacturer shall carry out the following special tests:

- measurement of sound pressure level (according to [NEN-EN-IEC 60076-10](#));
- measurement of zero sequence (according to [NEN-EN-IEC 60076-1](#));
- measurement of surface treatment/coating (according to [MSW-11-E](#));
- frequency response analysis (according to [NEN-EN-IEC 60076-18](#));
- measurement of partial discharge (according to [NEN-EN-IEC 60076-3](#)).

For the testing of protection devices a type test report of the device is accepted.

9.5 Acceptance/rejection criteria

Client will reject the acceptance of the transformer in case of:

- deviations regarding the defined criteria of:
 - load and no load losses;
 - short circuit impedance.
- routine tests are not successful;
- damages.

If the actual no-load and load losses are above the by vendor guaranteed losses but within acceptable tolerances for client, the transformer will be accepted but a penalty will be charged.

10. INFORMATION TO BE SUBMITTED BY SERVICE PROVIDER

In the service provider's offer, the following information shall be supplied:

- An extensive description of the transformer and all its auxiliary items, regarding information about, for example:
 - manufacturer;
 - types;
 - use of materials;
 - sizes;
 - weights.
- Completion of the data sheet in annex B.
- Type test results, see § 9.3.

Any possible reference shall be to documents that are included in the offer.

For further required drawings/documents reference is made to the RED form (see annex C).

11. TRANSPORTATION AND ERECTION ON SITE

The following specifications are applicable for:

- transportation [MSA-25-E](#);
- storage [MSA-23-N](#);
- safety requirements during erection on site [CSA-38-E](#).

A DATA SHEET DISTRIBUTION TRANSFORMER

For datasheets of the distribution voltage transformers, see documents:

- S-003843-EF-A435-308_Att_E-1 for datasheet of the 400 kVA liquid immersed transformers

Legend



Purchaser/user completed data entry. To be confirmed or indicated as deviation by the supplier.

B DATA SHEET SERVICE PROVIDER DISTRIBUTION TRANSFORMER

For datasheets of the distribution voltage transformers, see documents:

- S-003843-EF-A435-308_Att_E-1 for datasheet of the 400 kVA liquid immersed transformers

Legend



Supplier/manufacturer completed data entry.

C RED DISTRIBUTION TRANSFORMER

REQUIREMENTS FOR DOCUMENTS (RED)	Specification no.: S.003843-EF-A435-308_Att_E	
	Related to: Underground Hydrogen Storage	
	UHS - HyStock	
Distribution transformer	Page 1 of 2	Rev.: A
Legend: P = Number of prints DF = Digital file in PDF format W/O = Required number of weeks after purchase order issue ¹⁾ W/A = Required number of weeks after release by Gasunie Inspection ²⁾		

TYPE OF DOCUMENTS	REQUIRED							FOR NOTES, SEE PAGE 2
	Inquiry	For approval ³⁾			Final			
	DF	P	DF	W/O	P	DF	W/A	
A GENERAL DOCUMENTS								
A1 General arrangement drawings	☒		☒	3		☒	2	
A2 Manufacturing Data Book	☐		☐			☒	0	
A3 Data / curves	☐		☐			☒	2	
A4 Completed data sheets	☒		☒	3		☐		
B ENGINEERING DOCUMENTS (Mechanical)								
B1 Construction drawings	☐		☒	3		☒	2	
B2 Material parts list	☐		☒	3		☒	2	
B3 Dimensional drawings and weight data for handling	☒		☒	3		☒	2	
B4 Design calculations	☐		☐			☐		
B5 Thermal design calculations	☐		☐			☐		
B6 Completed data sheets	☐		☐			☐		
B7 Data/curves	☐		☐			☐		
B8 Test data/curves	☐		☐			☐		
B9 Noise limitation data sheet	☐		☐			☐		
B10 Vibration analysis	☐		☐			☐		
B11 Hazard analyses	☐		☐			☐		
B12 Foundation loading plan	☐		☒	3		☒	2	
C ENGINEERING DOCUMENTS (E&I)								
C1 Logic diagram/functional diagram	☐		☐			☐		
C2 Wiring diagrams	☐		☐			☐		
C3 Loop diagrams	☐		☐			☐		
C4 Connection diagrams	☐		☒	3		☒	2	
C5 EMC test proposal	☐		☐			☐		
C6 EMC test report	☐		☐			☐		
C7 ATEX explosion-proof certificates	☐		☐			☐		
C8 Software documentation	☐		☐			☐		
D OPERATING DOCUMENTS								
D1 Installation instructions	☐		☐			☒	2	
D2 Operating manual	☐		☒	3		☒	2	
D3 Maintenance manual	☐		☒	3		☒	2	
D4 Spare parts list	☒		☒	3		☒	2	
E INSPECTION AND TEST DOCUMENTS								
E1 Inspection and Test Plan (ITP) ⁴⁾	☐		☒	3		☒	0	
E2 Test report	☐		☐			☒	2	

GENERAL NOTES TO REQUIREMENTS FOR DOCUMENTS (RED)

Specification no.: S.003843-EF-A435-308_Att_E

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Rev.: A

General:

- a. All documents required for inquiry shall be submitted with the quotation to Gasunie's Procurement Department.
- b. All documents shall be submitted to client with a properly addressed transmittal form (GTS_REQ-003 and GTS_REQ-004) for the attention of the department as specified.
- c. Any deviations from the timing for submission of documents shall be notified to Gasunie's Procurement Department by letter or e-mail.
- d. Each document shall bear the item or tag number and the Gasunie purchase order number and shall be dispatched in time to meet the required dates as specified in the purchase order.
- e. All documents should preferably be in Dutch. English may be used as an alternative.
- f. Dimensions used on engineering documents shall be in SI units. Nominal pipe sizes may also be indicated in imperial units between brackets.
- g. The following standard sizes shall be used: A4, A3, A2 and A1.
- h. Drawings consisting of five or more pages shall be treated as a package. A package shall include a front page, an index page and a revision page. The lay-out of these pages shall be submitted to the service provider by client's engineer.
- i. Data sheets are to be completed if applicable.

Notes:

- 1) Lead time for client's approval is 10 working days. Shop fabrication shall not be started before the required engineering documents have been released for construction (A- or B-approved) by client.
- 2) Release note will be submitted after Manufacturing Data Book has been uploaded on Qdocs.
- 3) Documents such as drawings, calculations and the like that already have been approved by client are not required for resubmission for approval in the case of the following Purchase Order(s).
- 4) Approval on major aspects. Final approval during Pre Inspection Meeting after engineering documents have been "released for construction".

Manufacturing Data Book:

Contents:

- A. General documents
- B. Engineering documents (Mechanical)
- C. Engineering documents (E&I)
- D. Operating documents
- E. Inspection and test documents*
 - * E1 Approved ITP followed by documents as mentioned in the ITP.

Row	S-720D Data Sheet for Transformers				 JIP33 JOINT INDUSTRY PROGRAMME	Issue
2	Tag No. :	S.003843-EF-A435-308_Att_E-1_Datasheet - 400 kVA liquid immersed transformers		Revision: A	Date: 27-06-2024	
3	Service :	GU Zuidwending - Underground Hydrogen Storage (HyStock)		Reference: VBS-09-E (Attachment B)		
4	Ref. Clause	Description			Additional notes	
5	1. General					
6		Manufacturer :				
7		Vendor :				
		Origin :				
8		Equipment identifier :	TR-00001 & TR-00002 TR-00003 TR-L0901 TR-Z0901 & TR-Z1001			
9		Quantity :	6			
10	9.3	Type of liquid preservation system :	completely sealed type		Hermetically sealed	
11	4.1, 5.7.1, A.1.1 a) to x)	Service :	lighting and small power transformer			
12		Conformity assessment system :	C		based on routine testing - review (not witnessed)	
13	2. Environmental conditions					
14	5.5, A.1.1a) to x)	Altitude (if more than 1000m or 3280ft) :		m	<100m	
15	4.2 a) to e), 4.2 f, A.1.1 a) to x)	Minimum ambient temperature :	-33	°C		
16	4.2 a) to e), 4.2 f, A.1.1 a) to x)	Maximum ambient temperature :	40	°C		
17	4.2 a) to e), A.1.1 a) to x)	Yearly average ambient temperature :	15	°C		
18	5.5, A.1.1 a) to x)	Design ambient temperature (if more than 40 °C or 104 °F) :		°C	n.a.	
19	4.2 a) to e), 4.2 f, A.1.1 a) to x)	Relative humidity at maximum operating temperature (if more than 90 %) :	10-100	%		
20	4.2 f	Climatic conditions (K) for liquid immersed transformer :	4K23		zie IEC60721-3-4	
21	4.2 f	Special climatic conditions (Z) for liquid immersed transformer :			n.a.	
22	4.2 f	Biological conditions (B) for liquid immersed transformer :	4B1		zie IEC60721-3-4	
23	4.2 f	Chemically active substances (C) for liquid immersed transformer :			n.a.	
24	4.2 f	Mechanically active substances (S) for liquid immersed transformer :	4S10		zie IEC60721-3-4	
25	4.2 f	Mechanical conditions (M) for liquid immersed transformer :	4M10		zie IEC60721-3-4	
26	9.6.18.1, 9.6.18.3	Corrosion class :	C5	-->C5H		
27	A.1.1 a) to x)	Seismic zone as per IEC 60721-2-6, figure 5 :			n.a.	
28	4.2 f, 4.2 i, 5.7.4.2, A.1.1 a) to x)	Location :	outdoor			
29	A.1.1 a) to x)	Unusual service conditions :	No			
30	5.7.3, 5.7.3	Sound power level :	74	dB(A)	maximum value in sound report of the project	
31	3. Hazardous area classification					
32	4.2 g, A.1.1 a) to x)	Hazardous area classification zone :	non hazardous			
33	4.2 g, A.1.1 a) to x)	Hazardous area classification gas group :			n.a.	
34	4.2 g, A.1.1 a) to x)	Hazardous area classification temperature class :			n.a.	
35	4. Technical data					
36	4.1 Electrical system data					
37	5.4.1, A.1.1 a) to x)	Rated voltage (HV) :	33,0	kV	Um = 36kV	
38	5.4.1	Rated voltage (LV) :	0,41	kV		
39	5.4.1	Rated voltage (tertiary) :		kV	n.a.	
40	5.4.2, A.1.1 a) to x)	Rated frequency :	50	Hz		
41	A.1.1 a) to x), A.1.2 a) to t)	System short circuit apparent power :	1.385	MVA	PRELIMINARY	
42	6.4.3.e	Minimum full load power factor :	0,85			
43	A.1.1 a) to x), A.1.2 a) to t)	Supply voltage harmonic content :	≤ 5	%	THD	
44	4.2 Transformer/reactor data					
45	4.2.1 General					
46	Power frequency withstand voltage					
47	A.1.1 a) to x)	Power frequency withstand voltage - HV winding :	50	kV	IEC60076-3, table 2 (36 kV)	
48	A.1.1 a) to x)	Power frequency withstand voltage - LV winding :	3	kV	IEC60076-3, table 2 (<1 kV)	
49	A.1.1 a) to x)	Power frequency withstand voltage - tertiary winding :		kV	n.a.	
50	A.1.1 a) to x)	Power frequency withstand voltage - neutral terminal :	3	kV	IEC60076-3, table 2 (<1 kV)	
51	Lightning impulse withstand voltage					
52	A.1.1 a) to x)	Lightning impulse withstand voltage - HV winding :	170	kV	IEC60076-3, table 2 (36 kV)	
53	A.1.1 a) to x)	Lightning impulse withstand voltage - LV winding :		kV	n.a.	
54	A.1.1 a) to x)	Lightning impulse withstand voltage - tertiary winding :		kV	n.a.	
55	A.1.1 a) to x)	Lightning impulse withstand voltage - neutral terminal :		kV	n.a.	
56	5.7.2, 7.1.1, A.1.1 a) to x)	Number of phases :	3			
57	6.4.3.a, A.1.1 a) to x)	Direction of power flow :	step-down			
58	7.1.5, 5.7.2, 7.1.1, A.1.1 a) to x)	Connection and phase displacement symbol (vector group) :	Dyn5		PRELIMINARY	
59	A.1.1 a) to x), A.1.2 a) to t), B.4	Percentage impedance on air natural rating at principal tap :	4	%	PRELIMINARY	
60	5.7.2	High limit for zero sequence impedance :		ohms/ph	Manuf. Standard	
61	5.7.2	Low limit for zero sequence impedance :		Ohms/ph	Manuf. Standard	
62	5.1.1, A.1.1 a) to x)	Rated power in air natural mode (HV) :	400	kVA		

Row	S-720D Data Sheet for Transformers				 JIP33 JOINT INDUSTRY PROGRAMME	Issue
2	Tag No. :	S.003843-EF-A435-308_Att_E-1_Datasheet - 400 kVA liquid immersed transformers		Revision: A	Date: 27-06-2024	
3	Service :	GU Zuidwending - Underground Hydrogen Storage (HyStock)		Reference: VBS-09-E (Attachment B)		
63	5.1.1, A.1.1 a) to x)	Rated power in air natural mode (LV) :	400	kVA		
64	5.1.1, A.1.1 a) to x)	Rated power in air natural mode (tertiary) :		kVA	n.a.	
65	5.1.1, 5.1.3, A.1.1 a) to x)	Rated power in forced cooling mode (HV) :		kVA	n.a.	
66	5.1.1, 5.1.3, A.1.1 a) to x)	Rated power in forced cooling mode (LV) :		kVA	n.a.	
67	5.1.1, 5.1.3, A.1.1 a) to x)	Rated power in forced cooling mode (tertiary) :		kVA	n.a.	
68	5.4.3	Variation in V/Hz ratio from no load to rated load when exceeding 105 % :		%	according to IEC	
69	A.1.1 a) to x), A.1.2 a) to t), A.2 a) to f)	Parallel operation :	No			
70	5.1.1	Requirement of 1.8 times overloading for transformer feeding a group of motors :	No			
71	5.8, A.1.1 a) to x)	Insulating liquid :	mineral oil		Syntethic/organic options by manufacturer	
72	A.1.1 a) to x), A.1.2 a) to t), Table 1	Tolerance on total losses when not in accordance with IEC 60076-1 :		%	according to IEC	
73	6.5, A.1.1 a) to x), A.1.2 a) to t), Table 1	Tolerance on impedance value when not in accordance with IEC 60076-1 :		%	according to IEC	
74	4.2.2 Neutral terminal					
75	9.4	Level of DC current in neutral :		%	n.a.	
76	A.1.1 a) to x)	Transformer neutral earthing for HV winding :			n.a.	
77	A.1.1 a) to x)	Transformer neutral earthing for LV winding :	solid			
78	A.1.1 a) to x)	Transformer neutral earthing for tertiary winding :			n.a.	
79	9.2	Sizing of the low voltage neutral terminal :	100	%		
80	4.2.3 Winding					
81	A.1.1 a) to x)	Winding conductor material :	copper		Copper preferred, Aluminium allowed	
82	5.7.2	Requirement of delta connected stabilizing winding :	No			
83	5.7.2	Method of earthing of delta connected stabilizing winding :			n.a.	
84	A.1.1 a) to x)	Winding class of insulation :	B		Hotspot temp 110°C	
85	A.1.1 a) to x)	Non-uniform (graded) insulation :			yes / no	
86	A.1.1 a) to x)	High temperature insulation :			yes / no	
87	A.1.2 a) to t)	Thermally upgraded paper :			yes / no	
88	4.2.4 Termination					
89	A.1.1 a) to x), A.1.2 a) to t)	Main external termination details (HV) :	exposed bushings		cable	
90	A.1.1 a) to x), A.1.2 a) to t)	Main external termination details (LV) :	busduct		L1 / L2 / L3 / PEN	
91	A.1.1 a) to x), A.1.2 a) to t)	Main external termination details (tertiary) :			n.a.	
92	A.1.1 a) to x), A.1.2 a) to t)	Main external termination details (neutral) :	busduct			
93	A.1.1 a) to x), A.1.2 a) to t)	Cable box type :	air insulated			
94	A.1.1 a) to x)	Main cable box design :			split HV / LV, IP54	
95	A.1.1 a) to x)	Cable type :	insulated			
96	A.1.1 a) to x)	Number of cables (HV) :	1		+ cable gland for HV cable	
97	A.1.1 a) to x)	Number of cables (LV) :		BUSBAR	n.a.	
98	A.1.1 a) to x)	Number of cables (tertiary) :			n.a.	
99	9.6.11.1.4, A.1.1 a) to x)	Cable conductor size (HV) :	120	mm²		
100	9.6.11.1.4	Cable conductor size (LV) :	240	mm²	PRELIMINARY	
101	9.6.11.1.4	Cable conductor size (tertiary) :		Select	n.a.	
102	9.6.11.1.4, A.1.1 a) to x)	Number of cores per cable (HV) :	3			
103	9.6.11.1.4	Number of cores per cable (LV) :	1		n.a.	
104	9.6.11.1.4	Number of cores per cable (tertiary) :			n.a.	
105	9.6.11.1.4, A.1.1 a) to x)	Number of cables per phase (HV) :	1			
106	9.6.11.1.4	Number of cables per phase (LV) :	2		n.a.	
107	9.6.11.1.4	Number of cables per phase (tertiary) :			n.a.	
108	5.6, A.1.1 a) to x)	Separate neutral terminal box :			n.a.	
109	9.6.9.5, A.1.1 a) to x)	Canopy required for cable box :	No			
110	9.6.9.7	Breather with dessicant or drain for main cable boxes :			yes / no	
111	A.1.1 a) to x)	Busduct type :			Manuf. Standard	
112	A.1.1(a) to x)	Bushings				
113	A.1.1 a) to x)	Type of bushings (HV) :	porcelain			
114	A.1.1 a) to x)	Type of bushings (LV) :	porcelain			
115	A.1.1 a) to x)	Type of bushings (tertiary) :			n.a.	
116	A.1.1 a) to x)	Type of bushings (neutral) :	porcelain			
117	4.2.5 Tap changer					
118	6.1, A.1.1 a) to x)	Tap changer required and type :	DETC		de-energized tap-changer	
119	6.4.2.a, 6.4.3.c	Voltage variation required on: :	HV			
120	A.1.1 a) to x)	Type of de-energized tap changer (DETC) :	hand operated			
121	9.6.17.2.2	Tap changer switching medium :	liquid			
122	6.2.a, 6.2.b, 6.2.c	Category of voltage variation :	CFVV		to be adviced by Vendor; CFVV, VFVV or CbVV	
123	6.4.1, 6.4.2.b, 6.4.3.b, 6.4.3.c, A.1.1 a) to x), B.4	Tapping range :	2,5	%		
124	6.4.1, 6.4.2.b, 6.4.3.b, 6.4.3.c, A.1.1 a) to x)	Number of tapping positions :	5			
125	6.4.3.b	Principal tapping position :	symmetrical			

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3	Service :	GU Zuidwending - Underground Hydrogen Storage (HyStock)		Reference: VBS-09-E (Attachment B)			
126	6.3	Maximum current tapping position :			Manuf. Standard		
127	9.6.17.3.4	Remote tap-changer cabinet for OLTC :	No				
128	4.2.6 Cooling						
129	5.2, 5.1.3, A.1.1 a) to x)	Type of cooling :	AFWF, ONAN		ONAN		
130	5.1.3, 9.3, A.1.2 a) to t)	Temperature rise of insulating liquid when not in accordance with IEC 60076-2 :	60		Kelvin, top oil		
131	5.1.3, A.1.2 a) to t)	Temperature rise of winding when not in accordance with IEC 60076-2 or IEC 60076-11 :	65		Kelvin		
132	4.2 a) to e)	Cooling water inlet temperature when not in accordance with IEC 60076-2 and IEC 60076-11 :			n.a.		
133	5.2	Provision for mounting of cooling fans :	No				
134	A.1.1 a) to x)	AF fan motor cabinet :			n.a.		
135	4.2.7 Miscellaneous requirements						
136	a. Construction						
137	A.1.1 a) to x)	Type of cover for liquid immersed transformer and reactor :			bolted or welded		
138	A.1.1 a) to x)	Surface finish of tank and radiators :	hot dip galvanized				
139	9.6.18.1	Painting class required :	H		C5H, according to GTS		
140	A.1.1 a) to x)	Paint shade :			Manuf. Standard		
141	b. Interface						
142	A.1.1 a) to x)	Auxiliary supply voltage details for cooling fans :		V	n.a.		
143	A.1.1 a) to x)	Auxiliary supply voltage details for RTCC :		V	n.a.		
144	8.3 d) to k)	Requirement of current transformer in neutral terminal box :	No				
145	A.1.1 a) to x)	Current transformer ratio :		A	n.a.		
146	A.1.1 a) to x)	Current transformer accuracy class :			n.a.		
147	A.1.1 a) to x)	Current transformer burden :		VA	n.a.		
148	c. Transport						
149	5.7.4.1, A.1.2 a) to t)	Limiting transportation dimensions (height) :	2.500	mm	Manuf. Standard		
150	5.7.4.1, A.1.2 a) to t)	Limiting transportation dimensions (width) :	2.500	mm	Manuf. Standard		
151	5.7.4.1, A.1.2 a) to t)	Limiting transportation dimensions (depth) :	2.500	mm	Manuf. Standard		
152	5.7.4.1, A.1.2 a) to t)	Limiting transportation weight :	no limit	kg	Manuf. Standard		
153	A.1.1(a) to x)	Impact recorder requirement during transportation :	Yes		including report		
154	5.7.4.2	Acceleration in excess of 1 g during transportation :	No				
155	4.3 Reactor specific requirements						
156	A.1.1 a) to x)	Application :			n.a.		
157	A.1.1 a) to x)	Rated current :		A	n.a.		
158	A.1.1 a) to x)	Rated short circuit current :		A	n.a.		
159	A.1.1 a) to x)	Time to withstand rated short circuit current :		s	n.a.		
160	6.5, A.1.1 a) to x)	Impedance at rated voltage and current :		Ohms	n.a.		
161	5. Accessories						
162	9.1.2, A.1.1 a) to x)	Lifting lugs :	Yes		and hauling lugs		
163	9.3, A.1.1 a) to x)	Silica gel breather for main tank :	No				
164	A.1.1 a) to x)	Type of silica gel breather :			n.a.		
165	A.1.1 a) to x), Annex F, Table F.1	Liquid level indicator :	No		hermetically sealed		
166	A.1.1 a) to x), Annex F, Table F.1	Magnetic liquid level gauge with alarm and trip contacts :	No				
167	9.6.3.4, 9.6.3.5, A.1.1 a) to x), Annex F, Table F.1	Buchholz relay with alarm and trip contacts :	No				
168	9.6.1.1, A.1.1 a) to x), Annex F	Pressure Relief Device (PRD) for transformer/reactor tank :	No				
169	9.6.1.1	Pressure relief device for OLTC :	No				
170	9.6.10.3.2	Pressure relief device for liquid filled cable box :	No				
171	9.6.1.3	Facility for directing emissions of liquid from the relief device in the direction specified :	No				
172	A.1.1 a) to x)	Sudden pressure relay :	No				
173	A.1.1 a) to x), Annex F, Table F.1	Liquid temperature Indicator with alarm and trip contacts :	Yes				
174	A.1.1 a) to x), Annex F, Table F.2	Winding temperature indicator with alarm and trip contacts :	Yes				
175	A.1.1 a) to x), Annex F, Table F.3	Winding temperature measurement type :	PT100 RTD		1 PT100 per winding and 1 PT100 for the core		
176	A.1.1 a) to x)	Cooling fans :	No				
177	A.1.1 a) to x)	Redundancy of cooling fans :			n.a.		
178	A.1.1 a) to x), Annex F, Table F.1	Control panel for fan starters (for AF type transformer) :			n.a.		
179	A.1.1 a) to x), Annex F, Table F.2	Marshalling box :	Yes		Terminal box		
180	A.1.1 a) to x)	HV cable box :	Yes				
181	A.1.1 a) to x)	LV cable box :	Yes				
182	A.1.1 a) to x)	Tertiary cable box :	No		n.a.		
184	9.6.13, A.1.1 a) to x)	Surge arrester requirement :	No				
185	9.6.13	Surge arrester class :			n.a.		
186	Annex F	Requirement of online dissolved gas analysis (DGA) :	Yes		DGPT2 relais. Relais shall be easily readable/accessible when the door(s) of the compact station are open.		
187	Annex F	Requirement of fiber optic temperature sensing :	No				
188	Annex F	Number of channels of fiber optic temperature sensor :			n.a.		

Row	S-720D Data Sheet for Transformers				JIP33 JOINT INDUSTRY PROGRAMME	Issue
2	Tag No. :	S.003843-EF-A435-308_Att_E-1_Datasheet - 400 kVA liquid immersed transformers		Revision: A	Date: 27-06-2024	
3	Service :	GU Zuidwending - Underground Hydrogen Storage (HyStock)		Reference: VBS-09-E (Attachment B)		
189	9.6.6.2	Core earthing terminals at accessible location. :			to be advised by Vendor	
190	9.6.6.3, A.1.1 a) to x)	Earthing cable lug size :		mm	earthing (bonding) 2x opposite site on transformer frame suitable for cable 95mm ² Each HV phase flag shall contain 20mm ball point* Each LV phase + N shall contain 20mm ball point* (* earthing provision shall be suitable for the short circuit current and will be used for external earthing possibility)	
193	9.3	Alarm contact for diaphragm failure for transformer with diaphragm in conservator :			n.a.	
194	A.1.1 a) to x)	Bi-directional rollers :			Vendor to advise	
		Clamps + Anti vibration pads	Yes			
195	4.2 f	Anti-condensation heater for cable box :	No			
196	9.6.17.3.5	Anti-condensation heater for remote tap-changer cabinet :			n.a.	
197	9.1.2. Note	Requirement of ladder :	Yes			
198	6. Design data from vendor					
199	6.1 Electrical parameters					
200	A.1.1 a) to x), A.1.2 a) to t)	No-load loss at rated voltage and principal tap :		kW		
201	A.1.1 a) to x), A.1.2 a) to t)	Load loss at rated voltage and principal tap :		kW		
202	A.1.1 a) to x)	Percentage regulation at unity power factor :		%		
203	A.1.1 a) to x)	Percentage regulation at 0.8 lagging power factor :		%		
204	5.1.1, A.1.1 a) to x)	Efficiency at unity power factor, 50 % load :		%		
205	5.1.1, A.1.1 a) to x)	Efficiency at unity power factor, 100 % load :		%		
206	5.1.1, 6.4.3.e, A.1.1 a) to x)	Efficiency at 0.8 lagging power factor, 50 % load :		%		
207	5.1.1, 6.4.3.e, A.1.1 a) to x)	Efficiency at 0.8 lagging power factor, 100 % load :		%		
208	6.5, 6.5, 6.5, A.1.1 a) to x), B.4	Percentage impedance on AN rating at principal tap :		%		
209	5.7.2, A.1.1 a) to x)	Zero sequence impedance :		Ohms/ph		
210	6.2 Construction					
211	A.1.1 a) to x)	Winding conductor material :			aluminium / copper	
212	Winding type					
213	A.1.1 a) to x)	HV :			foil / non-foil	
214	A.1.1 a) to x)	LV :			foil / non-foil	
215	A.1.1 a) to x)	Tertiary :			foil / non-foil	
216	A.1.1 a) to x)	Weight of core and windings :		kg		
217	A.1.1 a) to x), A.1.2 a) to t)	Total weight with insulating liquid :		kg		
218	A.1.1 a) to x)	Weight of insulating liquid :		kg		
219	5.8, A.1.1 a) to x)	Insulating liquid :			mineral oil / silicon oil /	
220	A.1.1 a) to x)	On-load tap changer make :	n.a.			
221	A.1.1 a) to x)	On-load tap changer power required :	n.a.	kW		
222	A.1.1 a) to x), A.1.2 a) to t)	Transformer overall assembled length :		mm		
223	A.1.1 a) to x), A.1.2 a) to t)	Transformer overall assembled width :		mm		
224	A.1.1 a) to x), A.1.2 a) to t)	Transformer overall assembled height :		mm		
225	A.1.1 a) to x)	Dimension details for remote tap changer cabinet length :	n.a.			
226	A.1.1 a) to x)	Dimension details for remote tap changer cabinet width :	n.a.			
227	A.1.1 a) to x)	Dimension details for remote tap changer cabinet height :	n.a.			
228	A.1.1 a) to x), A.1.2 a) to t)	Transportation weight :		kg		
229	5.7.3, A.1.1 a) to x), A.1.2 a) to t)	Sound power level :		dB(A)		
230	5.8, A.1.1 a) to x), A.1.2 a) to t)	Use of environmentally harmful materials :			yes / no	
231	4.2.f	Seismic zone certification :	n.a.			
232	7. Testing requirements					
233	11.1.3.a	Temperature rise test :	Yes		First (of 400 kVA) transformers shall be tested	
234	6.6.b	Temperature rise test at tapping other than the maximum current tapping :	No			
235	11.1.3.d	Power consumption of fans and liquid pump motors :	No			
236	11.1.3.b, A.1.2 a) to t)	Dielectric type tests :	Yes			
237	11.1.3.c	Sound level test :	Yes			
238	11.1.3.e	Measurement of no-load loss and current at 90 % and 110 % of rated voltage :	Yes			
239	11.1.4.a, A.1.2 a) to t)	Dielectric special tests :	No			

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3	Service :	GU Zuidwending - Underground Hydrogen Storage (HyStock)			Reference: VBS-09-E (Attachment B)		
240	11.1.4.b, A.1.2 a) to t)	Winding hot-spot temperature-rise measurements :	No				
241	11.1.4.c, A.1.2 a) to t)	Determination of capacitances windings-to-earth and between windings :	Yes				
242	11.1.4.e, A.1.2 a) to t)	Determination of transient voltage transfer characteristics :	Yes			PRELIMINARY	
243	11.1.4.f, A.1.2 a) to t)	Measurement of zero-sequence impedance :	Yes				
244	11.1.4.g, A.1.2 a) to t)	Short-circuit withstand test :	No				
245	11.1.4.i, A.1.2 a) to t)	Vacuum deflection test :	No			PRELIMINARY	
246	11.1.4.j, A.1.2 a) to t)	Pressure deflection test :	No			PRELIMINARY	
247	11.1.4	Pressure deflection test for OLTC tank :	No				
248	11.1.4.k, A.1.2 a) to t)	Vacuum tightness test :	No				
249	11.1.4	Vacuum tightness test for OLTC tank :	No				
250	11.1.4.l, A.1.2 a) to t)	Measurement of frequency response :	No				
251	11.1.4.m, A.1.2 a) to t)	Check of external coating :	Yes				
252	A.1.2 a) to t)	Measurement of dissolved gasses before and after dielectric tests :	Yes				
253	11.1.4.o, A.1.2 a) to t)	Mechanical test :	No				
254	11.1.4	Simulated transformer/motor on load start test for unit transformer :	No				
255	11.1.4	Routine test for Ex 'P' type transformer in accordance with IEC 60079-13 :	No				
256	11.1.4	Routine tests for Ex 'O' type transformer in accordance with IEC 60079-6 :	No				