

# Test and Commissioning Report for Automatic Voltage Regulator UNITROL® 1000

PLANT: NORNE 27.5MVA  
Unit: 2/2  
Serial-No.: HI 11045519-000010/2  
TYPE: UNITROL 1000-40A PM  
Order-No.: 11045519

## Approval signatures

The test procedure and report have been examined. The tested object has functions and performance according to its specifications with exceptions according to the exception list and the review comments.

The object has been tested in accordance with the conditions stipulated in the contract and observing relevant safety rules.

No findings were recorded

The following findings were recorded "Exception List" sheet no:

Follow up inspection; Not needed  Needed  Date/Place: \_\_\_\_\_

## Certification

This certify that the acceptance test has been satisfactory completed, and the items are cleared to be delivered to the customer.

FAT : <Customer/Name/Date>

FAT : <ABB/Name/Date>

Site: <Customer/Name/Date>

Site: <ABB/Name/Date>

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Based on	3BHS116849 ZAB D30 Rev. F	Project	NORNE 27.5MVA		
Prep.	J. Ehlen	2007-04-02			
Appr.	S. Gentner	2007-04-03			
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## 1. GENERAL

The test procedure and report have been examined. The tested object has functions and performance according to its specifications with exceptions according to the exception list and the review comments.

**Test Specification:** see chapter 5ff.

**Date of the factory test:**

14. 6. 07

< Date >

**Factory test carried out by:**

geprüft 2007  
ATDP 133

M. E6ner

< Dept./initials of first name, family name >

**Date of the site test:**

< Date >

**Site test carried out by:**

< Dept./initials of first name, family name >

## 2. REFERENCE DOCUMENTS

The following documents are related to the item and to this document.

Identity	Document kind	Title
3BHS233870 E20		HW-Schematic
3BHS233870 E01		Assembly Drawing
3BHS201795 E80		User's Manual UNITROL 1000-15
3BHS200200 E80		User's Manual UNITROL 1000-PM40

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### 3. SYSTEM DATA

Signal	Parameter / Designation		Nominal value	Remarks
Apparent power	$S_N$	[MVA]	27.5	
Rated machine voltage	$U_M$ Nominal	[kV]	11.0	
Three- or two phase voltage measurement	PT		3-phase	
Primary voltage transformer	$U_M$ Primary	[kV]	11.0	
Secondary voltage transformer	$U_M$ Secondary	[V]	110	
Rated machine current	$I_M2$ Nominal	[A]	1443	
Primary current transformer	$I_M2$ Primary	[A]	2000	
Secondary current transformer	$I_M2$ Secondary	[A]	5.0/1.0	The intermediate transformer is used to adjust the input signal 5A to 1A for current input of UN1000 device
No-load field current $I_{f0}$	$I_e$ NoLoad	[A <sub>DC</sub> ]	2.4	
Rated field current $I_{fN}$	$I_{eN}$	[A <sub>DC</sub> ]	5.5	
Ceiling current $I_p$	$I_p$	[A <sub>DC</sub> ]	9.9	
No-load field voltage $U_{f0}$	$U_{e0}$	[V <sub>DC</sub> ]	13.4	
Rated field voltage $U_{fN}$	$U_{eN}$	[V <sub>DC</sub> ]	30.6	
Ceiling voltage $U_p$	$U_p$	[V <sub>DC</sub> ]	55.0	
Rated machine frequency	$f_N$	[Hz]	50	
Exciter frequency	$f_E$	[Hz]	400	
Machine reactance	$X_q$	[p.u]	1.52	
Battery supply voltage	$U_{Batt}$	[V <sub>DC</sub> ]	24	
Converter supply voltage	$U_{PWR}$	[V <sub>AC</sub> ]	230	Phase to phase
Converter supply mode			1-phase	Three-phase, one-phase or DC. Needed for Kcell calculation.

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## 4. Factory test

### 4.1 Visual Inspection

Action	Result	Rem. No.
• Condition of base plate (drilling, edges, surface...)	<input checked="" type="checkbox"/>	
• Arrangement of components	<input checked="" type="checkbox"/>	
• Touch guard, cables mounted in channel	<input checked="" type="checkbox"/>	
• Labeling of components according list of components	<input checked="" type="checkbox"/>	
• Status of UNITROL 1000 unit (status sticker) <i>(10"</i> )	<input checked="" type="checkbox"/>	
• 24h Hotline sticker beside to the plant nameplate putted on	<input checked="" type="checkbox"/>	
• Grounding of devices and components, ground bars	<input checked="" type="checkbox"/>	
• Check of the degrees of protection (IP)	<input checked="" type="checkbox"/>	

### 4.2 Setting of Devices

M.C.B.	Project.	Tester	Comm.
Q10	1025 A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Q11	10 A	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### 4.3 High Voltage Test

Action	Result	Rem. No.
• Power circuits	2000 V; 50 Hz; 1 Min	<input checked="" type="checkbox"/>
• Auxiliary circuits AC/DC	1500 V; 50 Hz; 1 Min	<input checked="" type="checkbox"/>
• PT and CT circuits	500 V; 50 Hz; 1 Min	<input checked="" type="checkbox"/>
• Measuring transducer (analog signals)	500 V; 50 Hz; 1 Min	<input checked="" type="checkbox"/>

### 4.4 Check of Supplies

(for this purpose the field breaker must be closed)

Action	Result	Rem. No.
• Auxiliary supply $U_{AUX}$ AC three-phase, one-phase or DC	<input checked="" type="checkbox"/>	
• Converter supply $U_{PWR}$ AC three-phase, one-phase or DC	<input checked="" type="checkbox"/>	

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## 4.5 Programming of Output Transducers

Settings SINEAX V604

U07/U06 [Auto setpoint 90..110%]		Project.	Tester	Comm
Input	4 to 20mA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Output	2 to 10V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

U08 [Excitation current]		Project.	Tester	Comm
Input	2 to 10V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Output	4 to 20mA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

## 4.6 Programming of the UNITROL 1000 Voltage Regulator

Action	Project.	Tester	Comm
Checking of software version on base device	---	4.310	--
Checking of software version on panel	---	4.310	--
Load parameter file	3BHS233870.ini	<input checked="" type="checkbox"/>	--

## 4.7 Functional Tests

Action	Result	Rem. No.
• Check wiring according HW diagram	<input checked="" type="checkbox"/>	
• Local operation	<input checked="" type="checkbox"/>	
• Binary inputs and outputs (remote operation)	<input checked="" type="checkbox"/>	
• Test of alarm and trip circuits	<input checked="" type="checkbox"/>	
• Actual value inputs	<input checked="" type="checkbox"/>	
• Analog inputs and outputs	<input checked="" type="checkbox"/>	
• Field flashing control	<input type="checkbox"/>	
• Converter light load test	<input checked="" type="checkbox"/>	
• Test transducer output	<input checked="" type="checkbox"/>	
• Special tests:		

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## 5. SITE TESTS

### 5.1 Pre-Tests (standing machine)

For actual parameter settings see parameter list

Checks	Result	Rem. No.
• Devices mounted properly, no visible damages	<input type="checkbox"/>	
• External wiring, external grounding	<input type="checkbox"/>	
• Device connection No. 7 is grounded	<input type="checkbox"/>	
Field resistance	Result	Rem. No.
• Field resistance including cables at 20°C	$\Omega$	
Supplies	Result	Rem. No.
• AC-Supply	V	
• DC-Supply	V	
Software	Result	Rem. No.
• Software version on base device	<input type="checkbox"/>	
• Adaptation of parameter settings	<input type="checkbox"/>	
Transducer	Result	Rem. No.
• Programming of transducers	<input type="checkbox"/>	
Control Circuits	Result	Rem. No.
• Check of all command inputs	<input type="checkbox"/>	
• Check of all signalisation outputs	<input type="checkbox"/>	
• Check of alarm- and trip-circuits	<input type="checkbox"/>	
• Control circuits for field-breaker	<input type="checkbox"/>	
• Field flashing control circuits	<input type="checkbox"/>	
• Check of PT's and CT's	<input type="checkbox"/>	
• Check of analog inputs and outputs	<input type="checkbox"/>	
Current tests on standing machine	Result	Rem. No.
• Optimization of manual channel with ref. value jumps	<input type="checkbox"/>	

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## 5.2 No Load Tests (machine at $n_{nom}$ )

Manual Channel		Result	Rem. No.
• Define limits of reference value and preset-value		<input type="checkbox"/>	
• Tuning of PI-Filter in MAN (with reference value jumps)		<input type="checkbox"/>	
• Check actual value measuring $U_M$		<input type="checkbox"/>	
Automatic Channel		Result	Rem. No.
• Field flashing and softstart		<input type="checkbox"/>	
• Define limits of reference value and preset-value		<input type="checkbox"/>	
• Tuning of PID-Filter		<input type="checkbox"/>	
• Settings and check of V/Hz-limiter		<input type="checkbox"/>	
• Check of deexcitation circuits (normal deexcitation and trip field breaker)		<input type="checkbox"/>	
• Definition of P/Q-droop resp. P/Q-compensation		<input type="checkbox"/>	
Channel Changeover		Result	Rem. No.
• Check changeover from AUTO to MAN and vice versa; smooth changeover		<input type="checkbox"/>	

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### 5.3 Load Tests (machine synchronized)

<b>General tests after synchronisation</b>		<b>Result</b>	<b>Rem. No.</b>
• Check generator current measurement / verification of P- and Q-measuring		<input type="checkbox"/>	
• Load rejections with $P \approx 0$ ; Q positive		<input type="checkbox"/>	
• Load rejections with $P \approx 0$ ; Q negative		<input type="checkbox"/>	
• AVR reference value jump on line to optimize dynamic behaviour		<input type="checkbox"/>	
• Manual channel reference value jump on line to optimize dynamic behaviour		<input type="checkbox"/>	
<b><math>I_{eMax}</math>-Limiter</b>		<b>Result</b>	<b>Rem. No.</b>
• Definition and check of $I_E$ -limitation		<input type="checkbox"/>	
• Jump into limitation to optimize dynamic behaviour		<input type="checkbox"/>	
<b><math>U_M</math>-Limiter</b>		<b>Result</b>	<b>Rem. No.</b>
• Definition and check of $U_M$ -limitation		<input type="checkbox"/>	
<b>P/Q-Limiter</b>		<b>Result</b>	<b>Rem. No.</b>
• Definition of P/Q-characteristic		<input type="checkbox"/>	
• Check of P/Q-limitation underexcited		<input type="checkbox"/>	
• Jump into limitation to optimize dynamic behaviour		<input type="checkbox"/>	
<b><math>I_{eMin}</math>-Limiter</b>		<b>Result</b>	<b>Rem. No.</b>
• Check of $I_{emin}$ -limitation underexcited		<input type="checkbox"/>	
<b>Superimposed cos phi-Regulator</b>		<b>Result</b>	<b>Rem. No.</b>
• Check stability and dynamic behaviour of Q-regulator		<input type="checkbox"/>	
• Check limits of cos phi-reference value		<input type="checkbox"/>	
• Check reference value settings by +/-buttons		<input type="checkbox"/>	
• Check reference value setting by analog input		<input type="checkbox"/>	
<b>Superimposed Q-Regulator</b>		<b>Result</b>	<b>Rem. No.</b>
• Check stability and dynamic behaviour of Q-regulator		<input type="checkbox"/>	
• Check limits of Q-reference value		<input type="checkbox"/>	
• Check reference value settings by +/-buttons		<input type="checkbox"/>	
• Check reference value setting by analog input		<input type="checkbox"/>	
<b>Special Tests</b>		<b>Result</b>	<b>Rem. No.</b>
•		<input type="checkbox"/>	

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## 5.4 Final Works

Action	Result	Rem.
• All screws fixed	<input type="checkbox"/>	
• Reset all temporary parameter settings	<input type="checkbox"/>	
• Save final parameter settings	<input type="checkbox"/>	
• Fill out the parameter list	<input type="checkbox"/>	
• All modifications in schematic diagram and commissioning protocol registered	<input type="checkbox"/>	
• Clients signature in commissioning protocol	<input type="checkbox"/>	
• Provisional acceptance report filled our and signed	<input type="checkbox"/>	

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## 6. USED INSTRUMENTS

### 6.1 Factory Test

Name / Type	Identification	Last Calibration
Multimeter Fluke III	037 096	08.2006
II	037 097	08.2006

### 6.2 Commissioning

Name / Type	Identification	Last Calibration

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## 7. EXCEPTION LIST

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