

**Shanghai Minghua Power Technology  
Engineering Co., Ltd**

**The performance test report for DE41-DE48 plus  
STG whole plant of Malta Delimara 3 plant**

Shanghai Minghua Power Technology Engineering Co.,Ltd

2800 Yangshupu Road, Shanghai, China

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**Abstract:**

Under the witness of Independent Engineer, Shanghai Minghua Power Technology Engineering Co., Ltd takes charge of carrying out the performance acceptance test of all eight engines in combined cycle (8+1) of Malta Delimara 3 power plant. And this performance test report presents the test results and conclusions of heat rate ,output power and emissions for the combined cycle tests.

**Key words:**

Performance acceptance test; Combined cycle; Heat rate; Output power; Emission;



## I The objective of test

Under the witness of Independent Engineer, Shanghai Minghua Power Technology Engineering Co., Ltd takes charge of carrying out the performance acceptance test of DE41-DE48 plus STG whole plant.

The objective of these tests is to measure the heat rate, power output and emission (including NO<sub>x</sub>, SO<sub>x</sub>, CO and PM) of all eight engines in combined cycle at various loads, thus providing the performance basis of whole plant on gas fuel mode.

## II Test condition

Table 2-1 Test condition and time of the test

NO.	Test condition	Contents of the test	Time and Date
1	80% load for DE41-DE48 engines	Test the output power and heat rate of eight engine when each engine reaches 80% load.	16:00—18:00 2018-03-08
2	80% load for combined cycle test of DE41-DE48	Test the output power and heat rate of combined cycle when each engine reaches 80% load.	16:00—18:00 2018-03-08
3	100% load for DE41-DE48 engines (8+1 preliminary test)	Test the output power and heat rate of eight engine when each engine reaches 100% load.	18:30—19:30 2018-03-08
4	100% load for combined cycle test of DE41-DE48 (8+1 formal test)	Test the output power and heat rate of combined cycle when each engine reaches 100% load.	19:30—21:30 2018-03-08

Note: (1) The test of DE41-DE48 engines and combined cycle are performed

simultaneously (e.g. test NO. 1 and NO. 2 will be done at the same time)

(2) Emission levels were recorded from CEMS readings at an half hour interval during the DE41-DE48 plus STG combined cycle test .

### **III Test standard**

3.1 Internal combustion engines -- Determination and method for the measurement of engine power -- General requirements. **ISO 15550:2002**

3.2 Reciprocating internal combustion engines; Performance; Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods-additional requirements for engines for general use. **ISO 3046**

### **IV Calculation methods of the performance test**

4.1 The heat rate calculation is explained in detail in 《The Performance Test Scheme for DE41-DE48 plus STG Whole Plant of Malta Delimara 3 Power Plant》 .

#### **4.2 Pilot fuel consumption of DF engines**

The pilot fuel consumption on DF engines was measured to be equivalent to 0.74 % of added energy to that of Gas fuel input rather than the original 1% quoted during commissioning by Wartsila. Thus pilot fuel energy on DF engines will be added accordingly since this cannot be physically measured through an engine-wise meter.

#### **4.3 Engine heat rate degradation with operating hours**

Both DF and SG engine heat rate would be corrected by engine degradation with operation hours in accordance with the degradation curve from Wartsilla.

#### **4.4 Charge inlet temperature correction of SG engines**

Although It has been recently confirmed by Wartsila that SG engine heat rate goes up by appr.0.9% for every 10 degrees C rise in the charge air inlet temperature of



45 °C, the charge air inlet temperatures were maintained very close to 45 °C during the test. So the correction of charge air temperature is not used in the performance calculation.

4.5 Gas heating values (LHV) are based on GPRS Gas chromatograph on-site, the accuracy of which has been validated by previous gas sample analysis reports from accredited lab.

4.6 The calculation of 80% load test is based on the manual recordings from DCS screen and energy meter in Local Control Room.

4.7 The calculation of 100% load test is based on the data automatically downloaded from Simulated Dispatching Software (connected with DCS database), the accuracy of which have been validated and should be taken as the same with DCS readings. The original data is downloaded under the witness of Independent Engineer and the signed data sheet is attached in this report.

4.8 After the 80% load test was completed at 18:00 PM, all eight engines were increased to 100% load immediately and kept operating at full load very stably until the end of 100% load test at 21:30 PM. STG tripped at 19:15 PM due to an instrumentation fault related with steam inlet temperature signal. However, it can be seen from the DCS trend that STG output was kept averagely at 13.14MW from 18:10 to 19:10 PM while the eight engines were running stably at 100% full load. All parties, including Independent Engineer, agree that the 13.14MW STG output can be taken as valid for the remainder of the test in order to determine the plant heat rate and output.

## V Calculated result of the performance test

<b>DE41-DE48 plus STG combined cycle (80% load test, 2018/03/08 16:00-18:00)</b>				
Item	Symbol	Unit	16:00-17:00	17:00-18:00

Gross power of DE41	P <sub>41</sub>	kW	14662	14662
Gross power of DE42	P <sub>42</sub>	kW	14714	14709
Gross power of DE43	P <sub>43</sub>	kW	14708	14707
Gross power of DE44	P <sub>44</sub>	kW	14682	14689
Gross power of DE45	P <sub>45</sub>	kW	13334	13328
Gross power of DE46	P <sub>46</sub>	kW	13332	13327
Gross power of DE47	P <sub>47</sub>	kW	13345	13346
Gross power of DE48	P <sub>48</sub>	kW	13321	13321
Gross power of STG	P <sub>stg</sub>	kW	12092	11998
Gross power of STG Corr. to the reference condition	P <sub>stg-corr</sub>	kW	12026	11944
Mass of gas in to 41 engine	M <sub>41</sub>	kg/h	2368	2367
Mass of gas in to 42 engine	M <sub>42</sub>	kg/h	2335	2333
Mass of gas in to 43 engine	M <sub>43</sub>	kg/h	2353	2356
Mass of gas in to 44 engine	M <sub>44</sub>	kg/h	2340	2338
Mass of gas in to 45 engine	M <sub>45</sub>	kg/h	2210	2214



Mass of gas in to 46 engine	M <sub>46</sub>	kg/h	2219	2222
Mass of gas in to 47 engine	M <sub>47</sub>	kg/h	2211	2213
Mass of gas in to 48 engine	M <sub>48</sub>	kg/h	2238	2241
LHV of gas fuel	LHV	kJ/kg	49710	49710
DE41 engine heat rate	HR <sub>41-p</sub>	kJ/kWh	8023.97	8020.58
DE42 engine heat rate	HR <sub>42-p</sub>	kJ/kWh	7869.01	7864.94
DE43 engine heat rate	HR <sub>43-p</sub>	kJ/kWh	7934.75	7945.40
DE44 engine heat rate	HR <sub>44-p</sub>	kJ/kWh	7903.48	7892.96
DE45 engine heat rate (0.74% pilot included)	HR <sub>45-p</sub>	kJ/kWh	8267.18	8285.86
DE46 engine heat rate (0.74% pilot included)	HR <sub>46-p</sub>	kJ/kWh	8301.19	8315.53
DE47 engine heat rate (0.74% pilot included)	HR <sub>47-p</sub>	kJ/kWh	8263.64	8270.49
DE48 engine heat rate (0.74% pilot included)	HR <sub>48-p</sub>	kJ/kWh	8378.81	8390.04
Gross heat rate of DE41-DE48 plus STG combined cycle	HR	kJ/kWh	7323.12	7332.49
Average of DE41-DE48 combined cycle heat rate	HR-a	kJ/kWh	7327.80	

For the formal test of DE41-DE48 plus STG combined cycle at 80% load, gross power of DE41 is 14662 kW, gross power of DE42 is 14712 kW, gross power of

DE43 is 14708 kW, gross power of DE44 is 14686 kW, gross power of DE45 is 13331 kW, gross power of DE46 is 13330 kW, gross power of DE47 is 13346 kW, gross power of DE48 is 13321 kW and gross power of STG after correction is 11985 kW.

In total, the gross output power of DE41-DE48 plus STG combined cycle Corr. to reference condition is 124079 kW, combined cycle heat rate of DE41-DE48 plus STG Corr. to reference condition is 7327.80 kJ/kWh.

<b>DE41-DE48 plus STG combined cycle (100% load formal test, 2018/03/08 19:30-21:30)</b>				
Item	Symbol	Unit	19:30-20:30	20:30-21:30
Gross power of DE41	P <sub>41</sub>	kW	18340	18341
Gross power of DE42	P <sub>42</sub>	kW	18354	18382
Gross power of DE43	P <sub>43</sub>	kW	18377	18376
Gross power of DE44	P <sub>44</sub>	kW	18354	18362
Gross power of DE45	P <sub>45</sub>	kW	16671	16669
Gross power of DE46	P <sub>46</sub>	kW	16686	16664
Gross power of DE47	P <sub>47</sub>	kW	16656	16693
Gross power of DE48	P <sub>48</sub>	kW	16633	16631
Gross power of STG	P <sub>stg</sub>	kW	13140	13140

Gross power of STG Corr. to the reference condition	Pstg-co rr	kW	13193	13193
Mass of gas in to 41 engine	M <sub>41</sub>	kg/h	2896	2898
Mass of gas in to 42 engine	M <sub>42</sub>	kg/h	2873	2873
Mass of gas in to 43 engine	M <sub>43</sub>	kg/h	2890	2894
Mass of gas in to 44 engine	M <sub>44</sub>	kg/h	2878	2879
Mass of gas in to 45 engine	M <sub>45</sub>	kg/h	2656	2656
Mass of gas in to 46 engine	M <sub>46</sub>	kg/h	2663	2663
Mass of gas in to 47 engine	M <sub>47</sub>	kg/h	2660	2657
Mass of gas in to 48 engine	M <sub>48</sub>	kg/h	2667	2664
LHV of gas fuel	LHV	kJ/kg	49700	49700
DE41 engine heat rate	HR <sub>41-p</sub>	kJ/kWh	7843.53	7848.51
DE42 engine heat rate	HR <sub>42-p</sub>	kJ/kWh	7760.33	7748.51
DE43 engine heat rate	HR <sub>43-p</sub>	kJ/kWh	7798.29	7809.50
DE44 engine heat rate	HR <sub>44-p</sub>	kJ/kWh	7774.27	7773.57
DE45 engine heat rate (0.74% pilot included)	HR <sub>45-p</sub>	kJ/kWh	7945.17	7946.12



DE46 engine heat rate (0.74% pilot included)	HR <sub>46-p</sub>	kJ/kWh	7958.09	7968.59
DE47 engine heat rate (0.74% pilot included)	HR <sub>47-p</sub>	kJ/kWh	7963.86	7937.24
DE48 engine heat rate (0.74% pilot included)	HR <sub>48-p</sub>	kJ/kWh	7995.09	7987.05
Gross heat rate of DE41-DE48 plus STG combined cycle	HR	kJ/kWh	7197.72	7195.82
<b>Average of DE41-DE48 combined cycle heat rate</b>	<b>HR-a</b>	<b>kJ/kWh</b>	<b>7196.77</b>	

For the formal test of DE41-DE48 plus STG combined cycle at 100% load, gross power of DE41 is 18341 kW, gross power of DE42 is 18368 kW, gross power of DE43 is 18377 kW, gross power of DE44 is 18358 kW, gross power of DE45 is 16670 kW, gross power of DE46 is 16675 kW, gross power of DE47 is 16675 kW, gross power of DE48 is 16632 kW and gross power of STG after correction is 13193 kW.

In total, the gross output power of DE41-DE48 plus STG combined cycle Corr. to reference condition is 153288 kW, combined cycle heat rate of DE41-DE48 plus STG Corr. to reference condition is 7196.77 kJ/kWh.

## VI Emission recordings from CEMS

### Exhaust gas emission after abatement during DE41-DE48 plus STG combined cycle test (2018/03/08 16:00-18:00, 80% load test)

Item	Unit	Value			
Stack	-	Stack1	Stack2	Stack3	Stack4
O <sub>2</sub> -Content in exhaust gas	Vol.-%	11.07	11.5	11.9	11.8

Nitrogen oxides(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	22.5	26.3	32.5	38.5
Sulphur dioxides(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	0	0	0	0
Carbon monoxide(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	1.4	2.4	3.9	3.3
Particulate matters(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	1.8	3	0.4	0.7

**Exhaust gas emission after abatement during DE41-DE48 plus STG combined cycle test (2018/03/08 18:30-21:30, 100% load test )**

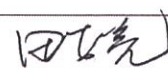
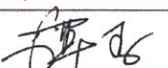
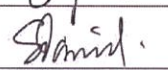
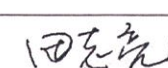
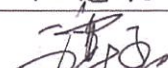
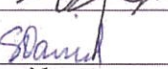
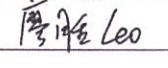
Item	Unit	Value			
Stack	-	Stack1	Stack2	Stack3	Stack4
O <sub>2</sub> -Content in exhaust gas	Vol.-%	11.63	11.51	11.47	11.49
Nitrogen oxides(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	36.39	35.49	32.42	35.86
Sulphur dioxides(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	0	0	0	0
Carbon monoxide(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	2.19	4.02	4.53	3.88
Particulate matters(corrected at 15% Vol.-O <sub>2</sub> )	mg/Nm <sup>3</sup> dry	3.57	3.49	0.49	1.10

## VII Attachment

### 7.1 Confirmation sheet of test implementation

#### The acceptance test for DE41-DE48 plus STG Whole Plant of Malta Delimara 3

##### Confirmation sheet of test implementation

At the beginning of test	1. All equipment of the unit is operating properly and system isolation condition conforms to test requirement.	
	2. All measuring instrument and meters conform to test requirement.	
	3. Test condition is in conformity with the test scheme.	
	4. Test personnel get familiar with the testing system, which conforms to test requirement.	
	All parties agree that test preparation work is well-done and the test can be formally started at 2018/02/08.	
	Signature of D3 representative	
	Signature of EPC representative	
	Signature of Independent Engineer	
At the end of test	1. All data recordings are effective.	
	2. All measurements and samples are effective.	
	3. Test condition and measurement are in conformity with test scheme	
	4. Other instructions:	
	All parties agree that this test condition is effective and the test can be formally ended at 2018/02/08.	
	Signature of D3 representative	
	Signature of EPC representative	
	Signature of Independent Engineer	
	Signature of test representative	



## 7.2 100% test data downloaded from SDS software

time	Output power of DE41 engine (accumulative signal)	Output power of DE42 engine (accumulative signal)	Output power of DE43 engine (accumulative signal)	Output power of DE44 engine (accumulative signal)	Output power of DE45 engine (accumulative signal)	Output power of DE46 engine (accumulative signal)	Output power of DE47 engine (accumulative signal)	Output power of DE48 engine (accumulative signal)
3/8/2018 18:30	367306.1944	407511.9724	405349.1783	407061.7403	402766.1781	336276.092	414876.9287	424973.7172
3/8/2018 19:00	367315.3594	407520.1544	405358.3633	407070.5143	402774.5291	336284.439	414885.2467	424982.0372
3/8/2018 19:30	367324.5184	407530.3664	405367.5493	407080.0833	402782.8391	336292.754	414893.5997	424990.3762
3/8/2018 20:00	367333.6974	407539.5334	405376.7333	407089.2693	402791.1731	336301.093	414901.9177	424998.6852
3/8/2018 20:30	367342.8584	407548.7204	405385.9263	407098.4573	402799.5101	336309.44	414910.2557	425007.0092
3/8/2018 21:00	367352.0114	407557.9224	405395.0993	407107.6083	402807.8311	336317.755	414918.6017	425015.3432
3/8/2018 21:30	367361.1994	407567.1024	405404.3023	407116.7993	402816.1791	336326.104	414926.9487	425023.6402

	Gas flow rate of DE41 engine (accumulative signal)	Gas flow rate of DE42 engine (accumulative signal)	Gas flow rate of DE43 engine (accumulative signal)	Gas flow rate of DE44 engine (accumulative signal)	Gas flow rate of DE45 engine (accumulative signal)	Gas flow rate of DE46 engine (accumulative signal)	Gas flow rate of DE47 engine (accumulative signal)	Gas flow rate of DE48 engine (accumulative signal)	Output Power of STG(accumulative signal)
3/8/2018 18:30	1744706	7725050	7037095	7592526	1063226	1441187	1185961	1517418	95428.47653
3/8/2018 19:00	1746155	7726488	7038538	7594362	1064552	1442517	1187390	1518750	95435.03653
3/8/2018 19:30	1747602	7727923	7039986	7595701	1065879	1443846	1188618	1520082	95438.60053
3/8/2018 20:00	1749050	7729360	7041431	7597139	1067207	1445178	1189947	1521415	95438.84453
3/8/2018 20:30	1750498	7730796	7042876	7598579	1068535	1446509	1191278	1522749	95438.84453
3/8/2018 21:00	1751946	7732232	7044322	7600018	1069862	1447840	1192607	1524082	95438.84453
3/8/2018 21:30	1753396	7733669	7045770	7601458	1071191	1449172	1193935	1525413	95438.84453

Steam turbine output average from 18:10 to 19:10 Pm is 13.14 MWh  
LHV of gas during 18:30 to 21:30 pm is 49.70 MJ/kg  
sea temperature from 18:30 to 21:30pm is 15.95 °C

STEPHEN DAVID  
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80% load condition

Time	Date	Hour:min	Decimal hours	DE41	DE42	DE43	DE44	DE45	DE46	DE47	DE48	DE49	DE50	DE51	DE52	DE53	DE54	DE55	DE56	DE57	DE58	DE59	DE60
8th March	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00	16:00-17:00
Atmosphere	101.25	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75	101.75
Atmosphere reference	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
Ambient temperature	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15	17.15
Charge air inlet temperature	44.5666667	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333	45.7333333
Charge air inlet temperature reference	44.5	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Sea water temperature	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667	15.6566667
Sea water temperature reference	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
Gas flow rate	2368	2335	2335	2340	2210	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219
Power	14662	14714	14708	14682	13334	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332	13332
LHV	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710	49710
Engine running hour up to date	671	2980	2702	2914	4744	4873	4811	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926	4926
Degradation factor by degradation curve	0.06%	0.25%	0.23%	0.24%	0.40%	0.41%	0.40%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%
Flow mass considering ① 0.74% DF	2366.68	2329.20	2347.70	2334.32	2217.55	2226.34	2218.43	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31
Flow mass considering ② Engine degradation with running hours	2366.68	2329.20	2347.70	2334.32	2217.55	2226.34	2218.43	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31	2245.31
Total heat	117647458.7	115784602.4	116704257.9	116038932.9	110274533.8	110671507	11078231.7	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5	111616172.5
Engine heat rate	8023.97	7869.01	7934.75	7903.48	8367.18	8301.19	8263.64	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81
SG/DF average heat rate	8023.97	7869.01	7934.75	7903.48	8367.18	8301.19	8263.64	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81	8378.81
STG power	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092	12092
DELTA STG	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13	-66.13
STG power correction	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87	12025.87
② ① Combined cycle Fuel rate	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12	7322.12
Average of formal test	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80	7327.80

David Gristle 9/3/18


Stuart MacDonald



## 7.4 Calibration certificate

Calibration certificate—Atmospheric pressure

该报告/证书已确认, 准予使用。  
2017年11月1日 确认人: 范群  
SMMS

 上海市气象信息与技术支撑中心  
气象计量所  
SHANGHAI METEOROLOGICAL IT SERVICE CENTER  
METEOROLOGICAL METROLOGY STATION

# 校准证书

CALIBRATION CERTIFICATE

证书编号 DP2017404  
Certificate No.

委托者 上海明华电力技术工程有限公司 13/  
Customer  
委托者地址 /  
Address of customer  
器具名称 空盒气压表  
Name of instrument 11-00-87-0181  
制造厂 上海铁品仪器仪表有限公司  
manufacturer  
型号/规格 DYM3  
Model/Specification  
器具编号 03218  
No. of instrument

证书批准人 范群 (职务: 所长)  
Approved by  
核验员 范群  
Checked by  
校准员 范群  
Calibrated by  
(机构校准专用章) SJ034 计量校准专用章  
校准日期 2017 年 11 月 01 日  
Date for calibrated Year Month Day

投诉电话: 021-67697092  
地址: 徐家汇蒲西路166号1号楼10楼 电话: 021-64383886 Tel. for complaint  
Address No.166 Puxi Road Xujiahui No 1 building tenth floor Tel  
邮政编码: 201615 传真: 021-67697092  
Post code Fax

未经本中心批准, 部分采用本证书内容无效。  
Partly using this certificate will not be admitted unless allowed by SMMS

第 1 页 共 2 页  
Page of total page

实验室认可证书号: SJ034 The number of the certificate accredited is	证书编号: DP2017404 Certificate No
本次校准所依据的技术规范 (代号、名称): JJG272-2007 空盒气压表和空盒气压计检定规程 Reference document for the calibration(code、name)	
本次校准所使用的主要标准器具: Main measurement standards used in this calibration  名称/型号: 数字压力计 Name/Model 测量范围: (800~1050) hPa measuring range 不确定度或准确度等级或最大允许误差: 0.01 级 Uncertainty accuracy class/maximum permissible error 以上计量标准器具的量值溯源至国家基准。 Quantity values of above measurement standards used in this calibration are traced to those of the national primary standards in the P.R.China	
校准地点及环境条件: Location and environmental condition for the calibration 地点: 松江九亭涞坊路 2030 号 Location 湿度: / %RH Relative humidity 温度: 21.5 °C Ambient temperature 其它: / Others	

本次校准结果的扩展不确定度: $U=0.4 \text{ hPa}$ , $k=2$ Expanded uncertainty																																												
校准结果/说明: Results of calibration and additional explanation 根据国家计量检定规程 JJG272-2007 进行校准。校准结果如下: 1. 温度系数(hPa/°C): +0.01 2. 示值修正值: <table border="1"> <thead> <tr> <th>标准表示值 (hPa)</th> <th>被测表示值 (hPa)</th> <th>气压点 (hPa)</th> <th>修正值 (hPa)</th> </tr> </thead> <tbody> <tr><td>1050.0</td><td>1049.9</td><td>1050.0</td><td>+1.2</td></tr> <tr><td>1030.0</td><td>1030.0</td><td>1040.0</td><td>+1.1</td></tr> <tr><td>1010.0</td><td>1010.9</td><td>1030.0</td><td>+1.0</td></tr> <tr><td>990.0</td><td>991.1</td><td>1020.0</td><td>+0.5</td></tr> <tr><td>960.0</td><td>961.8</td><td>1010.0</td><td>0.0</td></tr> <tr><td>960.0</td><td>961.8</td><td>1000.0</td><td>0.0</td></tr> <tr><td>990.0</td><td>991.1</td><td>990.0</td><td>-0.1</td></tr> <tr><td>1010.0</td><td>1011.0</td><td>980.0</td><td>-0.3</td></tr> <tr><td>1030.0</td><td>1030.0</td><td>970.0</td><td>-0.6</td></tr> <tr><td>1050.0</td><td>1049.7</td><td>960.0</td><td>-0.8</td></tr> </tbody> </table> 3. 补充修正值(hPa): -0.9 以下空白。	标准表示值 (hPa)	被测表示值 (hPa)	气压点 (hPa)	修正值 (hPa)	1050.0	1049.9	1050.0	+1.2	1030.0	1030.0	1040.0	+1.1	1010.0	1010.9	1030.0	+1.0	990.0	991.1	1020.0	+0.5	960.0	961.8	1010.0	0.0	960.0	961.8	1000.0	0.0	990.0	991.1	990.0	-0.1	1010.0	1011.0	980.0	-0.3	1030.0	1030.0	970.0	-0.6	1050.0	1049.7	960.0	-0.8
标准表示值 (hPa)	被测表示值 (hPa)	气压点 (hPa)	修正值 (hPa)																																									
1050.0	1049.9	1050.0	+1.2																																									
1030.0	1030.0	1040.0	+1.1																																									
1010.0	1010.9	1030.0	+1.0																																									
990.0	991.1	1020.0	+0.5																																									
960.0	961.8	1010.0	0.0																																									
960.0	961.8	1000.0	0.0																																									
990.0	991.1	990.0	-0.1																																									
1010.0	1011.0	980.0	-0.3																																									
1030.0	1030.0	970.0	-0.6																																									
1050.0	1049.7	960.0	-0.8																																									
本证书提供的结果仅对本次被校的器具有效。 The data are valid only for the instrument(s)																																												



Calibration certificate—Ambient humidity

   中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0134

校准证书编号: 2017E13-10-1272219001  
Calibrated certificate series No. 

该报告/证书已确认, 准予使用。  
2017年11月13日 确认人: 任学平

上海市计量测试技术研究院  
华东国家计量测试中心

# 校准证书

Calibration Certificate

委 托 者 上海明华电力技术工程有限公司  
Customer

委托者地址 /  
Address of customer

器具名称 简易数字温湿度计  
Name of Instrument

制 造 厂 /  
Manufacturer

型号/规格 /  
Model/Specification

器具编号 M-00-11-0908 SC002090  
No. of Instrument

器具准确度 /  
Instrument accuracy

批准人/职务 任学平 任学平 副所长  
Approved by / Functions

(机构校准专用章) 核 验 员 崔体运  
Checked by

校 准 员 张勇  
Calibrated by

校准日期 2017 年 10 月 26 日  
Date for calibrated Year Month Day


地址: 上海市张衡路1500号(总部) 电话: 021-38839800 传真: 021-50798390 邮编: 201203  
Address No.1500 Zhangheng Road, Shanghai(headquarters) Tel. Fax PostCode

客户咨询电话: 800-820-5172 投诉电话: 021-50798262  
Inquire line Tel. for complaint




未经本院/中心批准, 部分采用本证书内容无效。  
Partly using this report will not be admitted unless allowed by SIMT.


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  		校准证书编号: 2017E13-10-1272219001 Calibrated certificate series No.			
SHANGHAI INSTITUTE OF MEASUREMENT AND TESTING TECHNOLOGY NATIONAL CENTER OF MEASUREMENT AND TEST FOR EAST CHINA					
国家法定计量检定机构计量授权证书号(中心/院):(国)法计(2012)01039号/(2012)01019号 The number of the Certificate of Metrological Authorization to The Legal Metrological Verification Institution is No. (2012) 01039/ No. (2012) 01019					
本次校准所依据的技术规范(代号、名称): Reference documents for the calibration (code, name): JJF 1076-2001《湿度传感器校准规范》 JJG 874-2007《温度指示控制仪》					
本次校准所使用的主要计量标准器具: Main measurement standards used in this calibration					
名称 Name	型号规格 Model	编号 Number	测量范围 Measurement range	不确定度或准确度等级或最大允许误差 Uncertainty/Accuracy Class/Maximum Permissible Error	证书编号/有效期限 Certificate No./Due date
精密温湿度校准箱	EC30	1254-06	(30~95)%RH, (5~50)°C	波动度:±0.2% RH,±0.10°C均匀 度:1.0%RH,0.22°C	2017E13-30- 1178406001/ 2018-07-12
精密露点仪(湿度)	DEWPRIME II	26485/2396 X	(-15~45)°CDP	±0.2°C DP	2017E13-20- 1178412001/ 2018-07-12
精密露点仪(温度)	DEWPRIME II	26485	(0~50)°C	±0.1°C	2017E11-10- 1041447001/ 2018-02-15
/	/	/	/	/	/
以上计量标准器具的量值溯源至国家基准。 The value of a quantity of measurement standard used in this verification is traced to those of the national primary standards in the P.R. China.					
校准地点及环境条件: Location and environmental condition for the calibration					
地点: 院总部机械楼314室 Location 温度: (20~22)°C Ambient temperature 湿度: (60~65)%RH Relative humidity 其它: / Others					
备注: Note: /					
本证书提供的结果仅对本次被校的器具有效。 The data are valid only for the instrument(s).					
校准证书续页专用 Continued page of calibration certificate				第 2 页 共 3 页 Page of total pages	



   中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0134

校准证书编号: 2017E13-10-1272219001  
Calibrated certificate series No. 

SHANGHAI INSTITUTE OF MEASUREMENT AND TESTING TECHNOLOGY  
NATIONAL CENTER OF MEASUREMENT AND TEST FOR EAST CHINA

校准结果/说明:  
Results of calibration and additional explanation

温度/℃				
标准值	被测仪器示值		扩展不确定度(k=2)	技术要求
	IN	OUT		
15.0	15.5	15.3	0.3	MPE:±1.0
20.0	20.3	20.1		
30.0	29.8	29.9		

湿度/%RH(20℃)			
标准值	被测仪器示值	扩展不确定度(k=2)	技术要求
60.0	59		
80.0	83		

结论:温度IN示值误差符合JJG874-2007第4.1.1.2条的要求。  
温度OUT示值误差符合JJG874-2007第4.1.1.2条的要求。  
湿度示值误差符合JJF1076-2001第8.3条的要求。  
建议在2018年10月26日之前进行复校。  
校准结果内容结束

校准证书续页专用  
Continued page of calibration certificate


第 3 页 共 3 页  
Page of total pages



Calibration certificate—Electronic stopwatch

  		校准证书编号: 2017F34-10-1257284002 Calibrated certificate series No. 	
SHANGHAI INSTITUTE OF MEASUREMENT AND TESTING TECHNOLOGY NATIONAL CENTER OF MEASUREMENT AND TEST FOR EAST CHINA		该报告/证书已确认, 准予使用 2017年10月17日 确认人: 	
<b>上海市计量测试技术研究院</b> <b>华东国家计量测试中心</b> <b>校准证书</b> Calibration Certificate			
委托者	上海明华电力技术工程有限公司		
委托者地址	杨树浦路2800号		
器具名称	电子秒表		
制造厂	SASEY		
型号/规格	ZS-2AS		
器具编号	M-00-87-0176		
器具准确度	/		
批准人/职务	黄玉琿 室主任		
核验员	胡立志		
校准员	张帅		
校准日期	2017 年 10 月 16 日		
地址: 上海市张衡路1500号(总部)	电话: 021-38839800	传真: 021-50798390	邮编: 201203
客户咨询电话: 800-820-5172	投诉电话: 021-50798262		
未经本院/中心批准, 部分采用本证书内容无效。 Partly using this report will not be admitted unless allowed by SIMT.			
第 1 页 共 3 页		Page 1 of total 3 pages	



**SIMT** **ILAC-MRA** **CNAS** 校准证书编号: 2017F34-10-1257284002  
Calibrated certificate series No. 

SHANGHAI INSTITUTE OF MEASUREMENT AND TESTING TECHNOLOGY  
NATIONAL CENTER OF MEASUREMENT AND TEST FOR EAST CHINA

国家法定计量检定机构计量授权证书号(中心/院):(国)法计(2012)01039号/(2012)01019号  
The number of the Certificate of Metrological Authorization to The Legal Metrological Verification Institution is No. (2012) 01039/ No. (2012) 01019

本次校准所依据的技术规范(代号、名称):  
Reference documents for the calibration (code, name):  
JJG 237-2010 《秒表检定规程》

本次校准所使用的主要计量标准器具:  
Main measurement standards used in this calibration

名称 Name	型号规格 Model	编号 Number	测量范围 Measurement range	不确定度或准确度等级或最大允许误差 Uncertainty/Accuracy Class/Maximum Permissible Error	证书编号/有效期限 Certificate No./Due date
秒表测定仪	YQ-MB-1	14	(1~3600) s	$\pm(3 \times 10^{-7} \times T + 3 \text{ ms})$	2016F34-10-003993/ 2017-11-14
校表仪	Q TEST 6000	4263	(0.00~9.99) s	$\pm 0.01 \text{ s}$	2016F34-10-003994/ 2017-11-14
/	/	/	/	/	/

以上计量标准器具的量值溯源至国家基准。  
The value of a quantity of measurement standard used in this verification is traced to those of the national primary standards in the P.R. China.

校准地点及环境条件:  
Location and environmental condition for the calibration

地点: 院总部电学新楼305室  
Location

温度: 20℃ 湿度: 50%RH 其它: /  
Ambient temperature Relative humidity Others

备注: /  
Note

本证书提供的结果仅对本次被校的器具有效。  
The data are valid only for the instrument(s).

校准证书续页专用  
Continued page of calibration certificate

第 2 页 共 3 页  
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校准证书编号: 2017F34-10-1257284002  
Calibrated certificate series No.



校准结果/说明:

Results of calibration and additional explanation

一、时间间隔测量误差:

标准值	显示值	最大允许误差 (s)	误差 (s)	不确定度 (k=2)
10s	10s00	$\pm 0.05$	0.00	$U=0.01\text{ s}$
10min	10min00s00	$\pm 0.07$	0.00	
1h	1h00min00s	$\pm 0.10$	0	$U=1\text{ s}$

二、日差测量误差

标准值 (s)	显示值 (s)	最大允许误差 (s)	误差 (s)	不确定度 (k=2)
0.00	-0.41	$\pm 0.50$	-0.41	$U=0.01\text{ s}$

校准结果内容结束

校准证书续页专用  
Continued page of calibration certificate

第 3 页 共 3 页  
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