

METROPOLITAN VICKERS ELECTRICAL CO. LIMITED.

REPORT NO. ER.2690.

REPORT ON OFFICIAL TEST
OF
TURBINE & REDUCTION GEARS
AT RUGBY 9TH JUNE, 1936.

FOR: MESSRS. BARCLAY CURLE AND CO. LTD. FOR THE ELLERMAN LINES LTD.

RATING: 100 kW. AT 6500/800 RPM. 110 VOLTS.

TYPE OF TURBINE: H3C.14" 3 STAGE HIGH PRESSURE HORIZONTAL CURTIS

TYPE OF GENERATOR: COMPOUND WOUND WITH INTERPOLES - DRIP-PROOF.

TYPE OF GEARS: DOUBLE HELICAL SINGLE REDUCTION

SHOP ORDER NOS. Turbine B.802347. Gears B.802350.
Generator 416260/2.

SERIAL NOS. Turbine R.1861 Generator 416260/2/01.

TURBINE TESTS - Certified by (Signed) Ewd. H. Blade.....
Designing Engineer.

REPORT APPROVED

(Signed) Fred. H. Clough.....
Asst. Chief Engineer

DATE 22nd June 1936.



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W367

REPORT OF OFFICIAL TEST OF A 100 KW.
GEARED TURBO GENERATOR.

FOR MESSRS. BARCLAY CURLE AND CO.LTD. - FOR THE ELLERMAN LINES LTD.

TURBINE NO.R.1861.

The official test on this machine was run on the 9th June 1936, in the presence of Mr. Ward and Mr. Cairns of the Ellerman Lines, Mr. Laing of Lloyds, Mr. Walker of B.O.T. and Mr. Leivesley of Metropolitan Vickers Electrical Co.Ltd.

The test was commenced at 6 a.m. with a load of 100 kW. on the generator, this load being maintained until 12 noon. During the load run a steam consumption test was taken for one hour.

On completion of the above, governing and overspeed tests were made, followed by a two hours' run at 125 kW. load.

During the afternoon a short test was run with a load of 70 kW. on the generator, the turbine exhausting against atmospheric back pressure. The load was then increased to 150 kW. and maintained for one and a half minutes.

At each load at which a steam consumption was taken the set was run until the conditions were steady and then simultaneous readings at intervals of three minutes were taken of steam pressure, temperature, pressure at exhaust, weight of condensed steam and output of the generator.

The figures have been analysed and tabulated in Tables 2 and 3.

Correction Curve No. TEC. 3026A is bound in with this report, this having been used for correcting the test figures when operating to vacuum, to the guarantee conditions.

Table No.1 gives general details of the set.

Table No 4 gives particulars of governing trials and overspeed tests.



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REPORT OF OFFICIAL TEST OF 100 KW.
GEARED TURBO GENERATOR.

FOR MESSRS. BARKLEY, BIRNIE AND CO. LTD. - FOR THE ELLESMAN LINES LTD.

TURBINE NO. R.1861.

The official test on this machine was run on the 9th June 1936, in the presence of Mr. Ward and Mr. Lister of the Ellemann Lines, Mr. Lister of Lloyd's, Mr. Lister of B.C.T. and Mr. Lister of Metropolitan Vickers Electrical Co. Ltd.

The test was commenced at 8 a.m. with a load of 100 KW on the generator, this load being maintained until 12 noon. During the test a steam consumption test was taken for one hour.

On completion of the above, governing and over-speed tests were made, followed by a two hours' run at 125 KW load.

During the afternoon a short test was run with a load of 70 KW on the generator, the turbine exhausting against atmospheric back pressure. The load was then increased to 150 KW, and maintained for one and a half minutes.

At each load at which a steam consumption test was taken the set was run until the conditions were steady and then simultaneous readings at intervals of three minutes were taken of steam pressure, temperature, pressure at exhaust, weight of condensed steam and output of the generator.

The figures have been tabulated and tabulated in Tables 2 and 3.

Correction Curve No. 1000A is found in with this report, this having been used for correcting the test figures when operating to vacuum, to the standard conditions.

Table No. 1 gives general details of the set.

Table No. 4 gives particulars of governing trials and over-speed tests.

TABLE NO. I.	
TURBINE NO. R.1861.	
TURBO-GENERATOR	9th June, 1936
NORMAL OUTPUT	100 KW.
SPEED.	6500/800 RPM.
TURBINE.	6500/800 RPM.
TYPE.	H3C-14 3 STAGE HIGH PRESSURE HORIZONTAL CURTIS
TYPE OF BLADING	IMPULSE.
NUMBER OF ROTATING ROWS PER STAGE }	2 ROWS PER STAGE.
SPECIFIED STEAM PRESSURE.	150 LBS. PER SQ. INCH GAUGE.
SPECIFIED STEAM QUALITY.	DRY STEAM
SPECIFIED VACUUM }	28"
INCHES OF MERCURY }	
REDUCTION GEARS.	DOUBLE HELICAL SINGLE REDUCTION GEARS.
TYPE.	
GENERATOR.	COMPOUND WOUND WITH INTERPOLES DRIP-PROOF.
TYPE.	
VACUUM.	
TOTAL.	
STEAM CONSUMPTION LBS. PER KW. HR.	
CORRECTED TO 150 LBS./SQ. IN. GAUGE	
AT 28" VACUUM.	

TABLE NO. 1.
TURBINE NO. R. 1861.

TURBO-GENERATOR
NORMAL OUTPUT
SPEED.
TYPE.
TYPE OF BLADING
NUMBER OF ROTATING
ROWS PER STAGE
SPECIFIED STEAM PRESSURE.
SPECIFIED STEAM QUALITY.
SPECIFIED VACUUM
INCHES OF MERCURY
REDUCTION GEARS.
TYPE.
GENERATOR.
TYPE.
COMPOUND WOUND WITH INTERPOLES
DRIP-PROOF.

100 KW.
6500/800 RPM.
H30-1A 3 STAGE HIGH PRESSURE
HORIZONTAL CURTIS
IMPULSE.
2 ROWS PER STAGE.
150 LBS. PER SQ. INCH GAUGE.
DRY STEAM
28"
DO NOT REMOVE SINGLE
REDUCTION GEARS.
COMPOUND WOUND WITH INTERPOLES
DRIP-PROOF.

TABLE NO. 2.
TURBINE NO. R. 1861.

TEST NO.	1
DATE	9th June 1936
DURATION.	10-15 to 11-15 a.m.
OUTPUT OF GENERATOR	100 kw.
SPEED.	6500/800 RPM.
<u>STEAM CONDITIONS.</u>	
PRESSURE AT TURBINE LBS. PER SQ. INCH GAUGE.	148.1
TEMPERATURE AT TURBINE °F.	390.4
SUPERHEAT °F.	25.4
<u>EXHAUST.</u>	
VACUUM AT EXHAUST INCHES OF MERCURY (BAROMETER = 30")	27.60
<u>STEAM CONSUMPTION.</u>	
TOTAL WATER WEIGHED PER HOUR.	2680 LBS.
WATER USED PER KW. HOUR.	26.80 LBS.
<u>CORRECTIONS.</u>	
PRESSURE.	$\frac{1}{1.002}$
SUPERHEAT.	$\frac{1}{.983}$
VACUUM.	$\frac{1}{1.0277}$
TOTAL.	.9880
STEAM CONSUMPTION LBS. PER KW. HR. CORRECTED TO 150 LBS/SQ. IN. GAUGE DRY STEAM, 28" VACUUM.	26.48 LBS.

TABLE NO. 3.
TURBINE NO. R. 1861.

TEST NO. 1
DATE 9th June 1936
DURATION 10-15 to 11-15 A.M.
OUTPUT OF GENERATOR 100 KW.
SPEED 6500/800 RPM.

STEAM CONDITIONS.
PRESSURE AT TURBINE 80 INCH GAUGE. 139.75
TEMPERATURE AT TURBINE °F. 394.75
SUPERHEAT °F. 34.0

EXHAUST.
VACUUM AT EXHAUST 27.60
INCHES OF MERCURY (BAROMETER = 30")

STEAM CONSUMPTION.
TOTAL WATER WEIGHED 3960 LBS.
PER HOUR
WATER USED PER KW. HR. 56.57 LBS.

CORRECTIONS.
PRESSURE 1.005
SUPERHEAT 1.987
VACUUM 1.057
TOTAL 0.889

STEAM CONSUMPTION LBS. PER KW. HR. CORRECTED TO 150 LBS. PER SQ. INCH GAUGE DRY STEAM 56.35
VACUUM 28"

TABLE NO. 3.
TURBINE NO. R. 1861.

TEST NO. 2
DATE 9th JUNE 1936
DURATION 3-9 to 3-24
OUTPUT OF GENERATOR 70 kW.
SPEED 6500/800 RPM.

STEAM CONDITIONS.
PRESSURE AT TURBINE 139.75
LBS/SQ. IN. GAUGE.
TEMPERATURE AT TURBINE °F. 394.75
SUPERHEAT °F. 34.0

EXHAUST.
BACK PRESSURE 14.7
LBS. PER SQ. IN. ABSOLUTE.

STEAM CONSUMPTION.
TOTAL WATER WEIGHED 3960 LBS.
PER HOUR
WATER USED PER KW. HR. 56.57 LBS.

CORRECTION.
B.T.U.'s AVAILABLE PER LB. OF STEAM AT TEST CONDITION. 175.8
B.T.U.'s AVAILABLE PER LB. OF STEAM WITH 150 LBS/SQ. INCH GAUGE. DRY STEAM AND 14.7 LBS ABSOLUTE BACK PRESSURE. 176.47
TOTAL THEORETICAL CORRECT .9962
STEAM CONSUMPTION LBS/KW. HR. CORRECTED TO 150 LBS. PER SQ. INCH GAUGE DRY STEAM AND 14.7 LBS. PER SQ. INCH ABSOLUTE 56.35

TABLE NO. 4.
TURBINE NO. R. 1861

TEST NO.	3
DATE	24th JUNE 1936
DURATION	3-2 to 3-24
OUTPUT OF GENERATOR	10 KW.
SPEED	6500 RPM.
STEAM CONDITIONS	
PRESSURE AT TURBINE	132.75
TEMPERATURE AT TURBINE	394.75
SUPERHEAT	33.0
EXHAUST	
BACK PRESSURE	14.7
STEAM CONSUMPTION	
TOTAL WATER WEIGHED	3960 LBS.
PER HOUR	56.57 LBS.
WATER USED PER KW. HR.	
CORRECTION	
B.T.U.'s AVAILABLE PER LB. OF	175.8
STEAM AT TEST CONDITION	
B.T.U.'s AVAILABLE PER LB. OF	175.47
STEAM WITH 150 LBS. SQ. INCH	
GAUGE DRY STEAM AND 14.7 LBS.	
ABSOLUTE BACK PRESSURE	
TOTAL THEORETICAL CORRECT	3960
STEAM CONSUMPTION 150 LBS. SQ. INCH	
CORRECTED TO 150 LBS. PER SQ.	
INCH GAUGE DRY STEAM AND	
14.7 LBS. PER SQ. INCH ABSOLUTE	56.57

TABLE NO. 4.

TURBINE NO. R. 1861

GOVERNING.

The following governing readings were obtained with a load of 100 kW. thrown off and on the Generator.

Load on Generator	Governing Steady at 6500 RPM.
" off "	Momentary Speed = 6800 "
" off "	Steady speed = 6600 "
" on "	Momentary speed = 6400 "
" on "	Steady speed = 6500 "

The maximum momentary speed variation is therefore 4.62% and the steady speed variation 1.54%.

The emergency governor tripped at :-

1st Trial	= 7400 RPM.
2nd "	= 7150 "
3rd "	= 7100 "

The set was run at 15% overspeed i.e. 7475 RPM. for 5 minutes.

MGBS.