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.

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.

TABLE NO.I.

TURBINE NO.R.1861.

| | |
|---|---|
| **TURBO-GENERATOR** | |
| NORMAL OUTPUT | 100 KW. |
| SPEED. | 6500/800 RPM. |
| **TURBINE.** | |
| 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 INCHES OF MERCURY | 28" |
| **REDUCTION GEARS.** | |
| TYPE. | DOUBLE HELICAL SINGLE REDUCTION GEARS. |
| **GENERATOR.** | |
| TYPE. | 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. |
| **STEAM CONDITIONS.** | |
| PRESSURE AT TURBINE LBS. PER SQ.INCH GAUGE. | 148.1 |
| TEMPERATURE AT TURBINE °F. | 390.4 |
| SUPERHEAT °F. | 25.4 |
| **EXHAUST.** | |
| VACUUM AT EXHAUST INCHES OF MERCURY (BAROMETER = 30") | 27.60 |
| **STEAM CONSUMPTION.** | |
| TOTAL WATER WEIGHED PER HOUR. | 2680 LBS. |
| WATER USED PER KW. HOUR. | 26.80 LBS. |
| **CORRECTIONS.** | |
| 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. |

1

## 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 LBS/SQ.IN. GAUGE. | 139.75 |
| TEMPERATURE AT TURBINE °F. | 394.75 |
| SUPERHEAT °F. | 34.0 |
| **EXHAUST.** | |
| BACK PRESSURE LBS. PER SQ.IN. ABSOLUTE. | 14.7 |
| **STEAM CONSUMPTION.** | |
| TOTAL WATER WEIGHED PER HOUR | 3960 LBS. |
| 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 AVILABLE 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

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.