SPECIAL DATA

OPERATING CONDITIONS

	POWER (KW)	SPEED (RPM) TURBINE/GENERATOR	STEAM FLOW LBS./HR.
Normal Rated:	46 700	3 600	697 923

STEAM CONDITIONS

Inlet Pressure (psig):	845	#1 Extraction Pressure (psig):	176
Inlet Temperature (°F):	790	#2 Extraction Pressure (psig):	71
Exhaust Pressure (in. HgA):	1.5		

GOVERNOR SETTING

Refer to Operation Instruction Leaflet and Control Settings Diagram in Volume 1, Section I, Part 4.

SERVOMOTOR AND ACTUATOR LINKAGE

Stroke (inches): 7.88 (Inlet Stage)
Stroke (inches): 7.38 (Extraction Stage)
Stroke (inches): 7.62 (LP Extraction Stage)

Revised November, 1990

1.0 GENERAL DESCRIPTION

The turbine is a Westinghouse Model SC23 Condensing Steam Turbine designed for high reliability and efficiency. The operating conditions are detailed in Section I, Part 1. Turbine control is maintained with a Woodward 501D digital governor. Openings have been provided in the turbine casings to facilitate future modifications for controlled extraction operation.

The turbine is close coupled to an A.C. synchronous, TEWAC generator complete with overhung exciter.

Lubricating and control oil is provided from a remote oil console.

2.0 TURBINE ASSEMBLY

The turbine assembly is shown on the outline drawings and detailed on the longitudinal drawing. (Section I, Part 1). Detail descriptions of the assemblies are contained in the Instruction Leaflets contained in this manual.

The main components of the turbine assembly are the bearing brackets, cylinder and rotor. The cylinder is supported on the inlet and exhaust end bearing brackets. (Section I, Part 6).

The cylinder support paws extending from the inlet end rest on the inlet bearing bracket support assembly. The bearing brackets are anchored to the foundations. (Section I, Parts 7). The support assemblies maintain the vertical position of the cylinder but permit lateral and longitudinal thermal growth from a fixed anchor position at the turbine axial centerline and the exhaust lateral centerline. A centering beam which rigidly fixes the cylinder to the inlet bearing bracket maintains the axial position between the rotating and stationary components.

2.1 Turbine Cylinders

The turbine carcass is composed of an inlet cylinder and an exhaust cylinder, bolted together at a vertical joint. Both cylinders consist of a cover and a base which are tested for safe reliable operation at the design steam temperatures and pressures. (Section I, Part 1).

The cylinder covers and bases are bolted together at the horizontal joint using bolts, studs and dowel studs. Special bolt tightening procedures are used to provide correct tension and stretch. (Section I, Part 3).

2.1 Turbine Cylinders (Continued)

The inlet cylinder cover has two integral steam chests, one of which contains the inlet steam governing valves and seats. (Section I, Part 8). The other contains the extraction grid valve assembly (Section I, Part 8). The governing valves control the flow of steam into the turbine.

The extraction grid valve controls the pressure by passing the steam that is not extracted to the low pressure parts of the turbine.

During a turbine shutdown the cylinder cover may be removed to inspect the rotor, diaphragms and nozzle blocks. (Section I, Parts 5 & 6).

The stationary blade path components are supported inside the cylinder assembly and consist of nozzle diaphragm and nozzle block assemblies. (Section I, Part 6). These components position the stationary blades and nozzles vanes which direct the steam at the rotating blades. The stationary blades and nozzles vanes are made of 304 stainless steel which has superior corrosion and erosion resistance at elevated temperatures.

Steam leakage at the cylinder openings around the rotor is minimized using stepped labyrinth seals. The seals are held in cases and the assemblies are called glands. (Section I, Part 6).

2.2 Bearing Brackets

The bearing brackets support the cylinders assembly and rest on the foundations sole plates. The sole plates are positioned, leveled and grouted in place in the foundation as shown on the outline drawing (Section I, Part 1).

The exhaust end bearing bracket is a large steel fabrication, integral with the exhaust cylinder, which rigidly connects the cylinder to the foundation. The bracket contains a journal bearing and provides an enclosure for the coupling with a windage cover and appropriate shaft seals.

The inlet bearing bracket is centerline keyed to its sole plate. This permits thermal growth of the turbine rotating and stationary components in the axial direction, and maintains proper alignment while resisting lateral forces from the connecting steam piping. The inlet end bearing bracket contains a journal bearing, a thrust bearing, an overspeed and low oil pressure device, a self operating overrunning type clutch and provides a mounting for the turning gear motor assembly.

The bearings are of the tilting pad pressure lubricated type providing high support stiffness and dampening to minimize rotor vibration.

The thrust bearing supports turbine rotor thrust loads and accurately maintains rotor axial position relative to the stationary blades and nozzle blocks.

2.3 Overspeed and Low Oil Pressure Device

The overspeed and low oil pressure device will initiate turbine shutdown on overspeed or loss of bearing oil pressure.

Turbine shut down is accomplished by rapid closure of the T&T valve (Primary Shutdown), and closure of the governing valves (Secondary Shutdown). (Section I, Part 8).

2.4 Rotor

The rotor assembly consists of an alloy steel rotor with integral discs, bladed assemblies, coupling, overspeed trip mechanism, thrust collar and speed pickup toothed wheel. (Section I, Part 6). The rotor is machined from a Chromium, Molybdenum, Vanadium steel alloy forging designed for high stress, high temperature application.

The machining includes blade discs, steps for steam seals and bearing surfaces. Blade assemblies are designed to operate at high temperatures and stresses with minimal vibration. The blade assemblies consist of 403 stainless steel blades and shrouds. The blades transforms the energy contained in the steam to mechanical work. Full power is developed at operating speed.

3.0 TURBINE CONTROLS AND MONITORING

3.1 Governor

The turbine is controlled using a Woodward 501D digital governor (Section II).

Turbine speed load and inlet pressure are controlled by varying steam flow through governing steam valves.

A local control cubicle with gauges and tachometer is supplied to permit local starting and overspeed testing of the turbine (Section V).

3.2 Monitor Systems

The TG set is equipped with X-Y radial and axial probes to permit normal monitoring and full vibration signature analysis of the rotor (Section III).

The TG set is equipped with RTDs to monitor bearing pad temperatures. Vibration and Temperature levels are monitored by a Bently Nevada 7200 Monitor (Section III).

4.0 LUBRICATING AND CONTROL OIL SYSTEM

4.1 Oil Console

The Lube Oil Console provides 200 psi control oil and 15 psi lubricating oil to the TG set. (Section VII). The console consists of main, auxiliary and emergency backup lube oil pumps, plus main and auxiliary control oil pumps.

Dual oil coolers are provided to maintain the oil at 120°F. Dual filters provide 10 micron filtration on both the lube and control oil. The reservoir has 1300 U.S. Gallons capacity providing five minutes retention time.

The oil console and schematics provide additional details of the console assembly and operation. (Section VII).

4.2 Oil Characteristics

The characteristics of the lubricants recommended for use are given in the leaflet "Lubricant Specifications" (Section I, Part 4).

5.0 OPERATION AND MAINTENANCE

Instructions for the handling, installation, operation and maintenance and repair of the turbine are given in Volume 1. In any correspondence with the manufacturer regarding the turbine unit, always refer to the turbine serial number 26-S-8958. This reference facilitates a prompt reply, and speedy assistance or parts supply.

6.0 SAFETY DEVICES

No matter how good the speed-regulating governor on a turbine may be, circumstances can occur which will make it inoperative and the need for a fail safe emergency speed limiting device is universally acknowledged. The overspeed trip and low oil pressure device on this turbine is of the spring-opposed eccentric weight type which has demonstrated its adequacy throughout years of operating experience. This device will trip the turbine as described described in the applicable Instruction Leaflet (Section I, Part 7).

7.0 ACCESSORIES

Any special devices or accessories furnished with this turbine are described in individual leaflets. Refer to Overall Table of Contents for location.

ALLOWABLE PRESSURE AND TEMPERATURE VARIATIONS

The turbine rating, capability, steam flow, speed regulation and pressure control are based on operation at rated steam conditions. The turbine generator unit shall be capable of operation under the following variations in steam pressure and temperature. These allowable variations are intended to provide for operating emergencies and it is expected that such abnormal operation will be kept to a minimum, especially the occurrence of simultaneous variations in pressures and temperatures.

a) Pressure

The pressure at the turbine main steam inlet valve shall be controlled so that it does not exceed 105% of rated pressure. During abnormal conditions, the pressure may exceed rated pressure briefly by as much as 20%, but the aggregate duration of such brief swings beyond 105% of rated pressure shall not exceed 12 hours per 12 months operating period.

b) Temperature

The steam temperature at the turbine throttle valve inlet flange shall average not more than rated temperature over any 12 month operating period. In maintaining this average, the temperature shall not exceed rated temperature by more than 15°F.

During abnormal conditions, temperature shall not exceed rated temperature by more than 25°F, for operating periods not more than 400 hours per 12 month operation period, nor 50°F above rated temperature for swings of 15 minute duration or less, aggregating no more than 80 hours per 12 month operating periods.

TURBINE STEAM PURITY

Recommended lists for impurities commonly found in turbine steam are given in Table 1. The normal values are the Westinghouse recommendations for reliable turbine operation. These values represent limits where the impurity concentration in steam is below the expected solubility limit everywhere in the dry region of the turbine. The limiting conditions represent undesirable conditions which should be corrected to normal within the time periods indicated. Where better steam purity can be maintained, every effort shall be made to do so.

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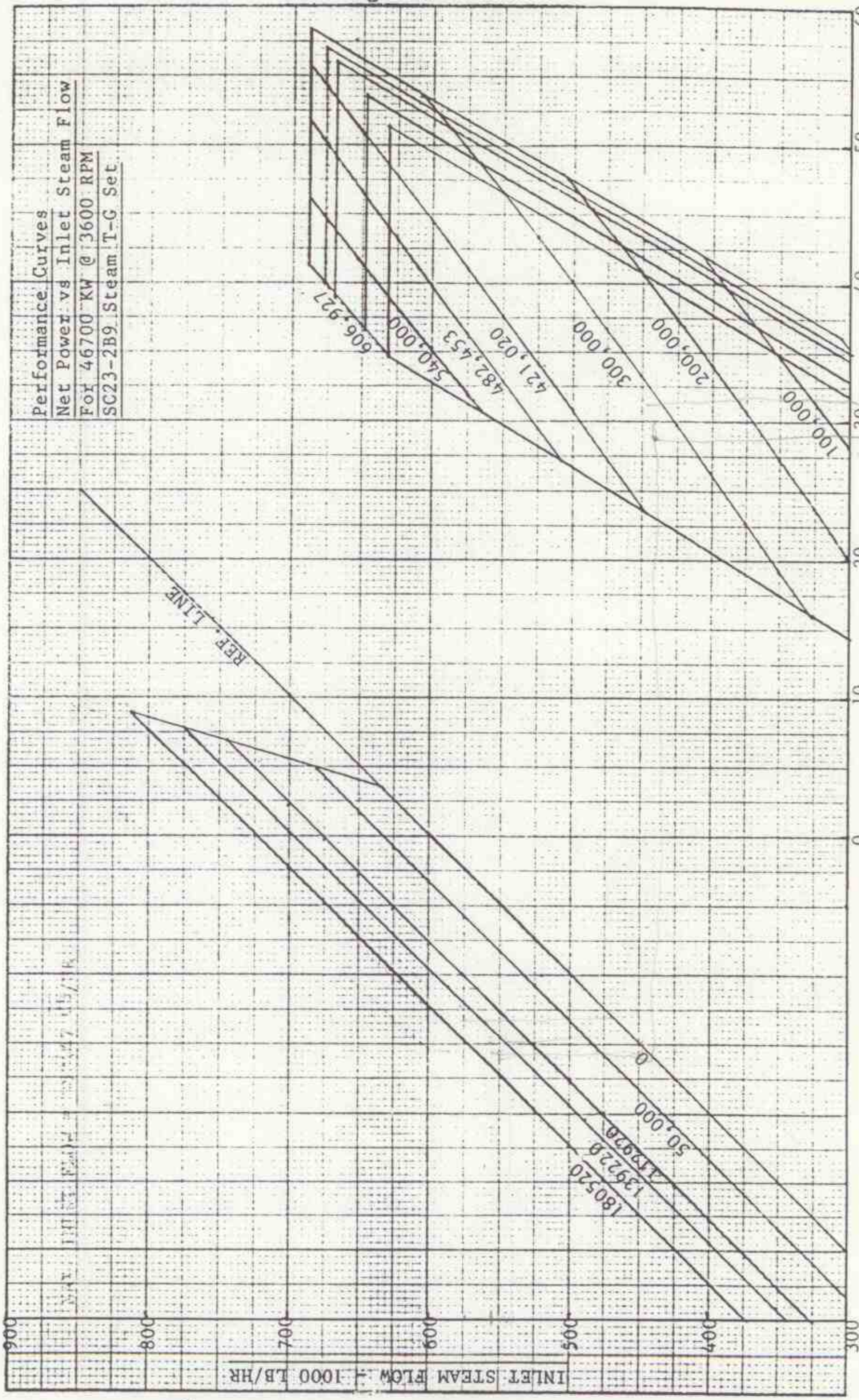

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FORM 827

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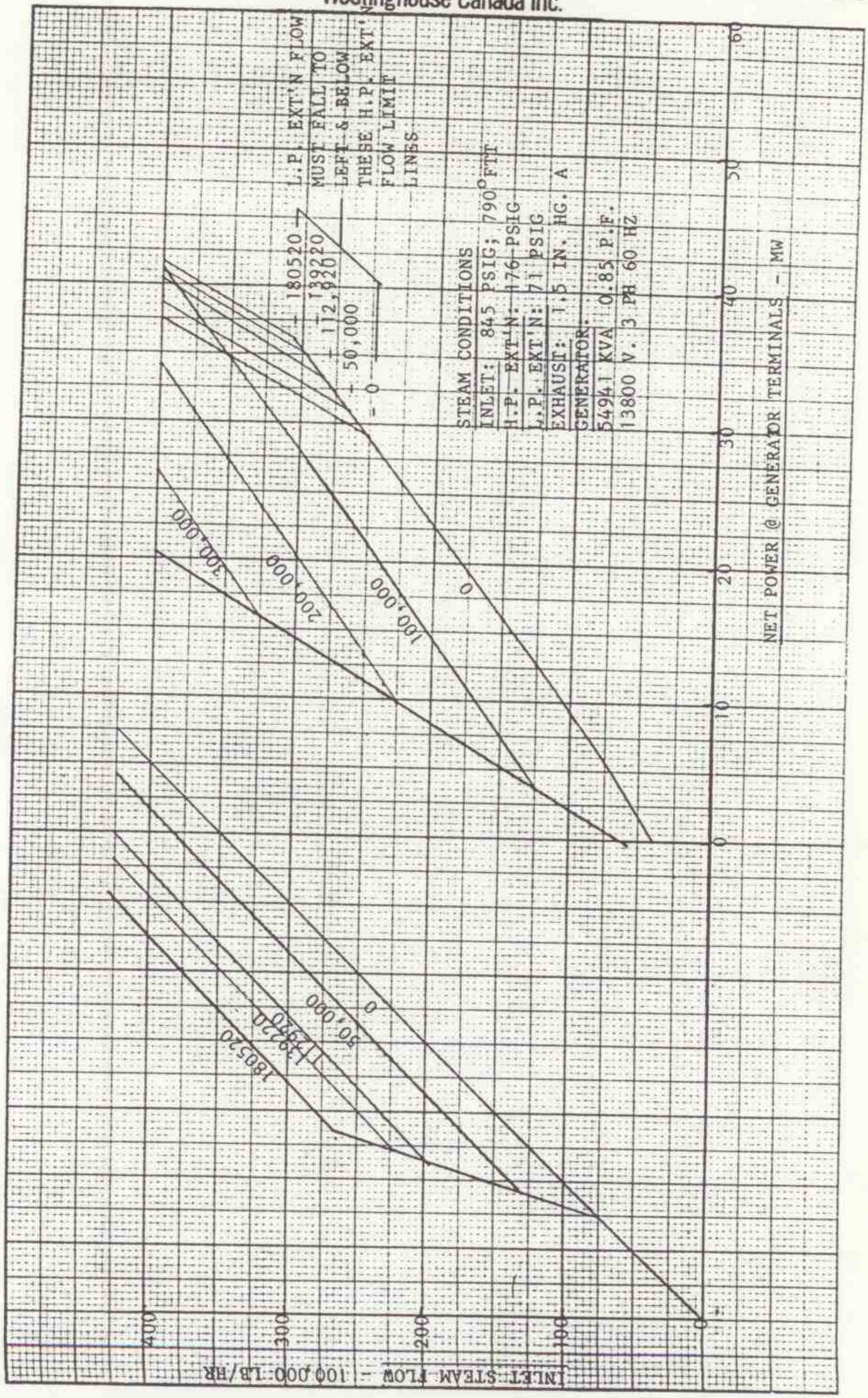

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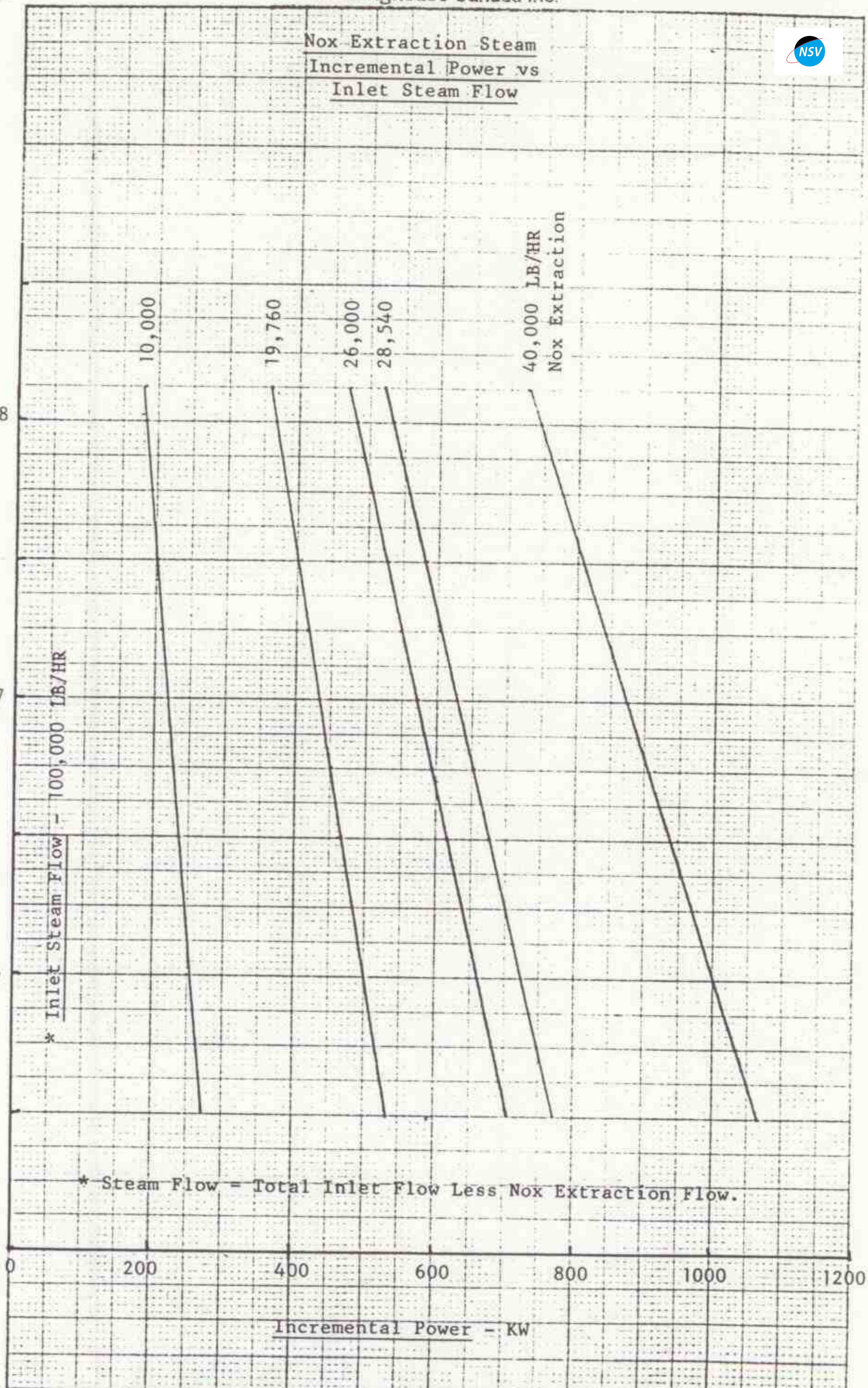

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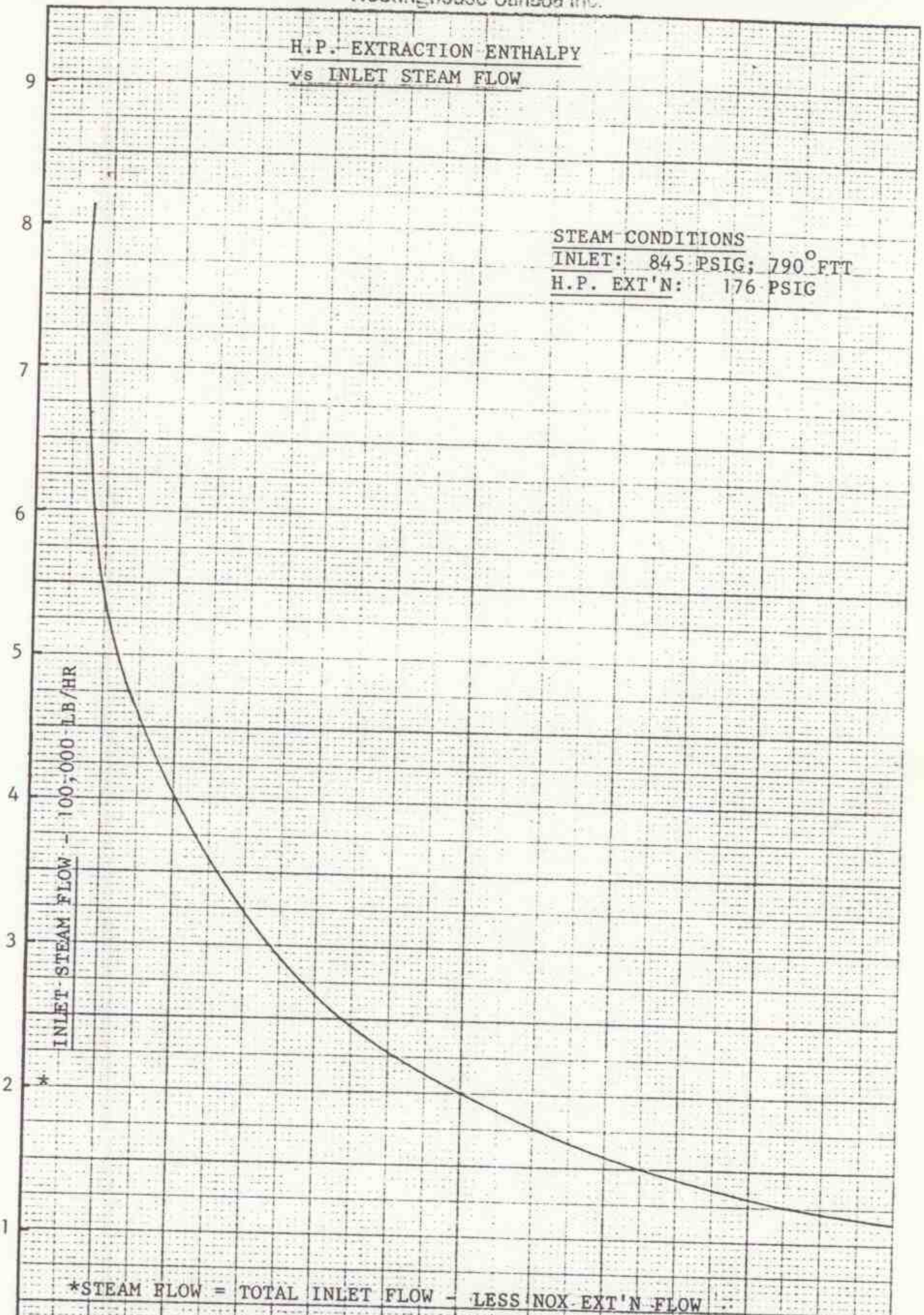

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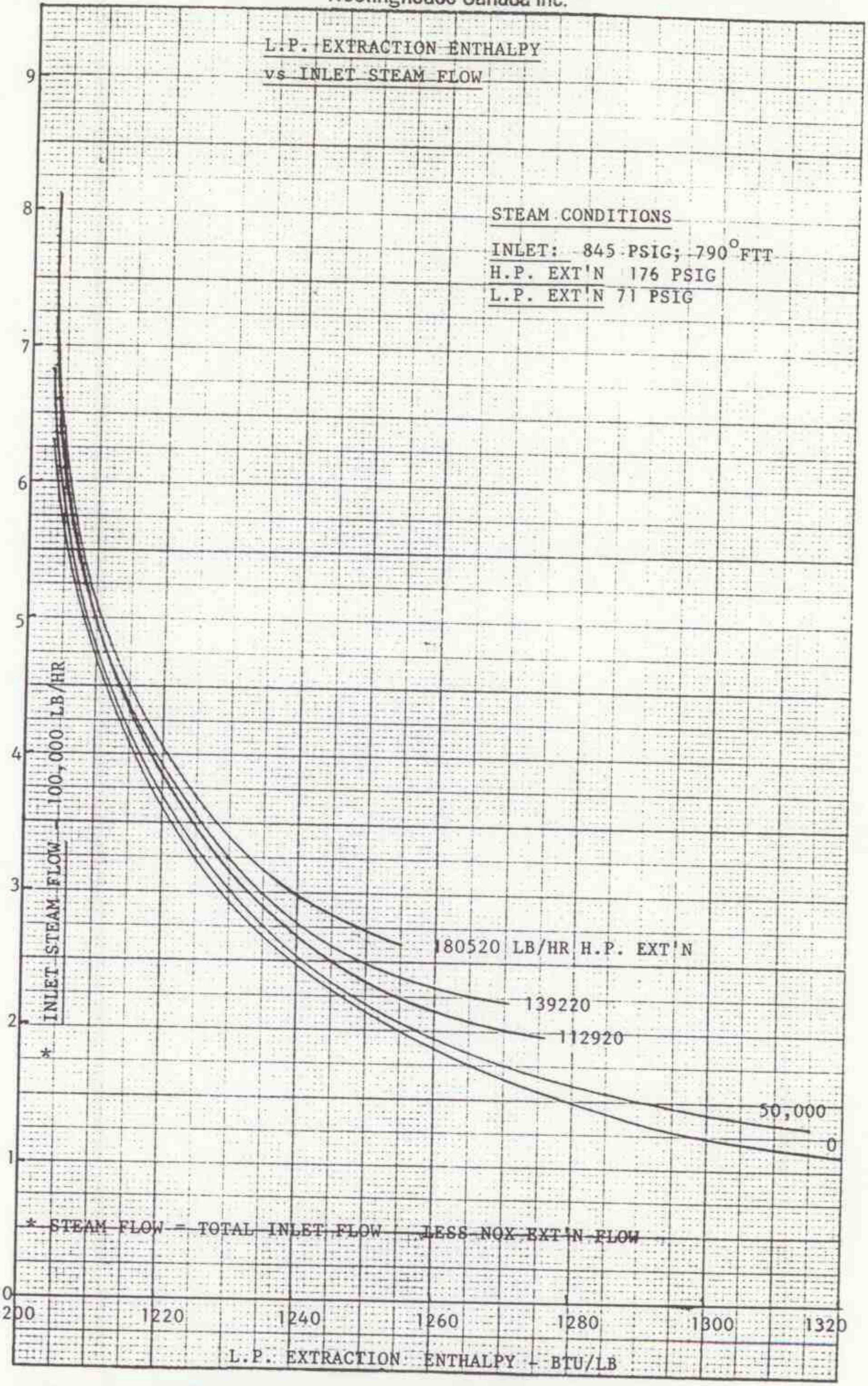

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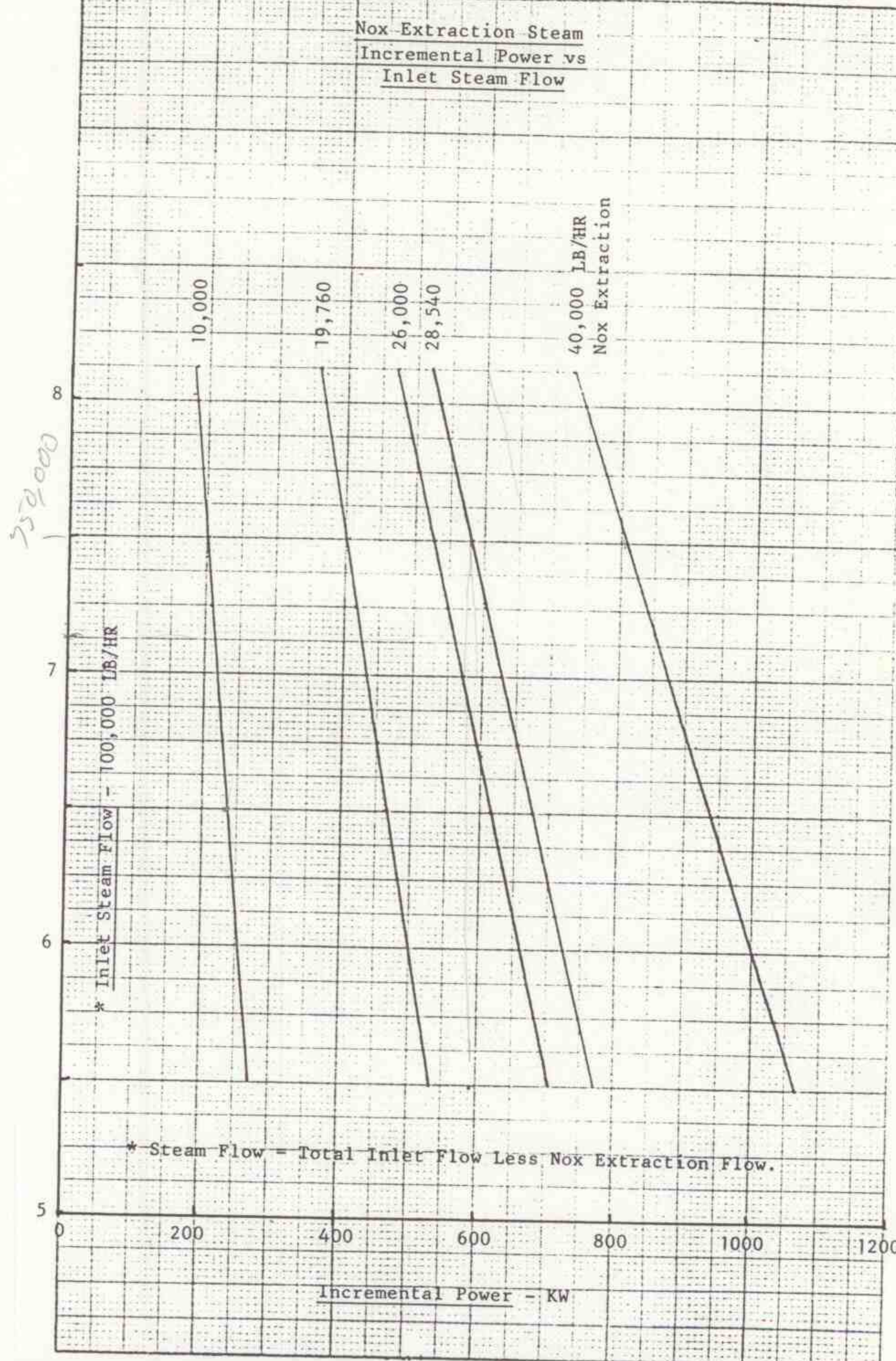

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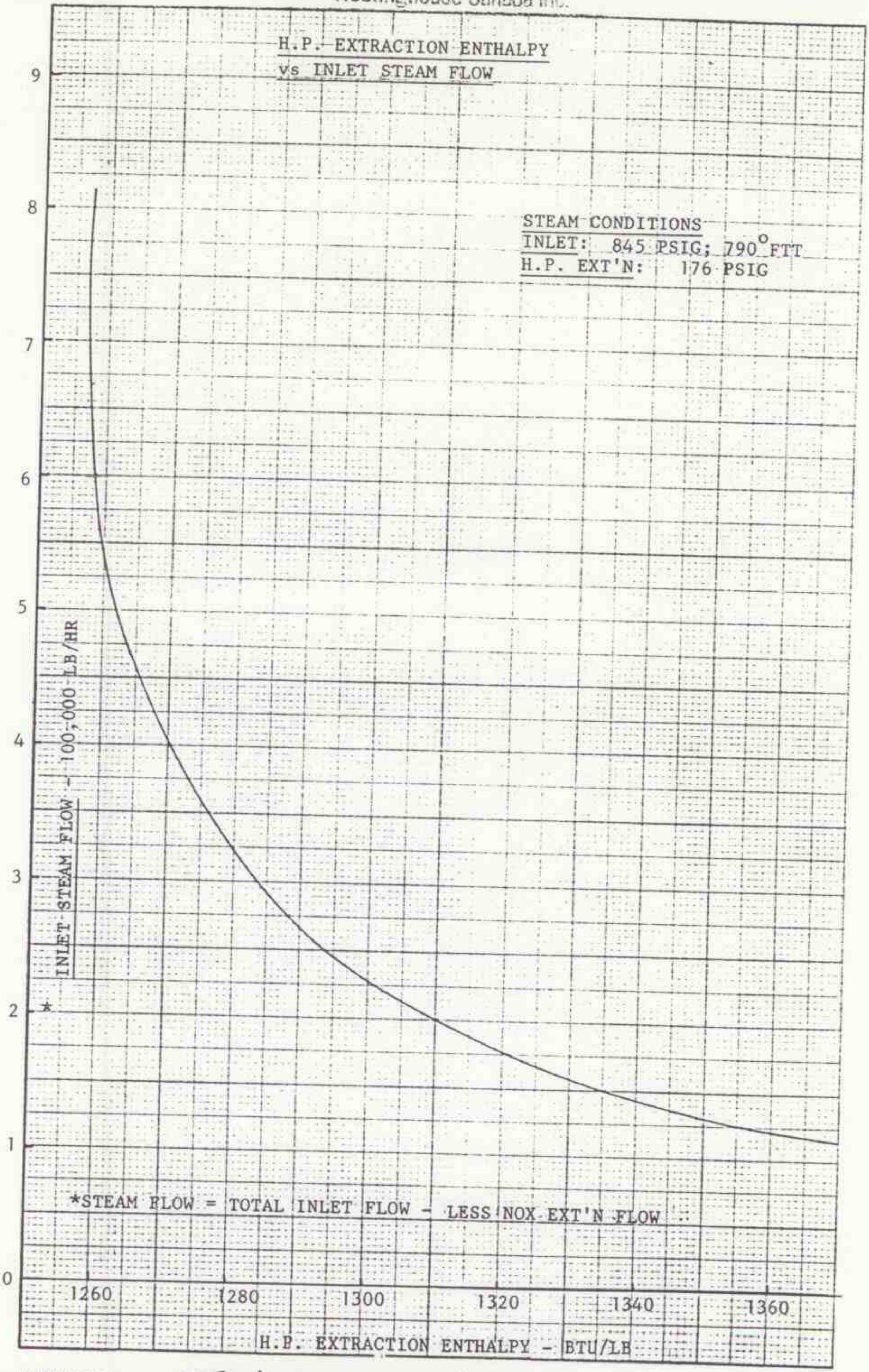

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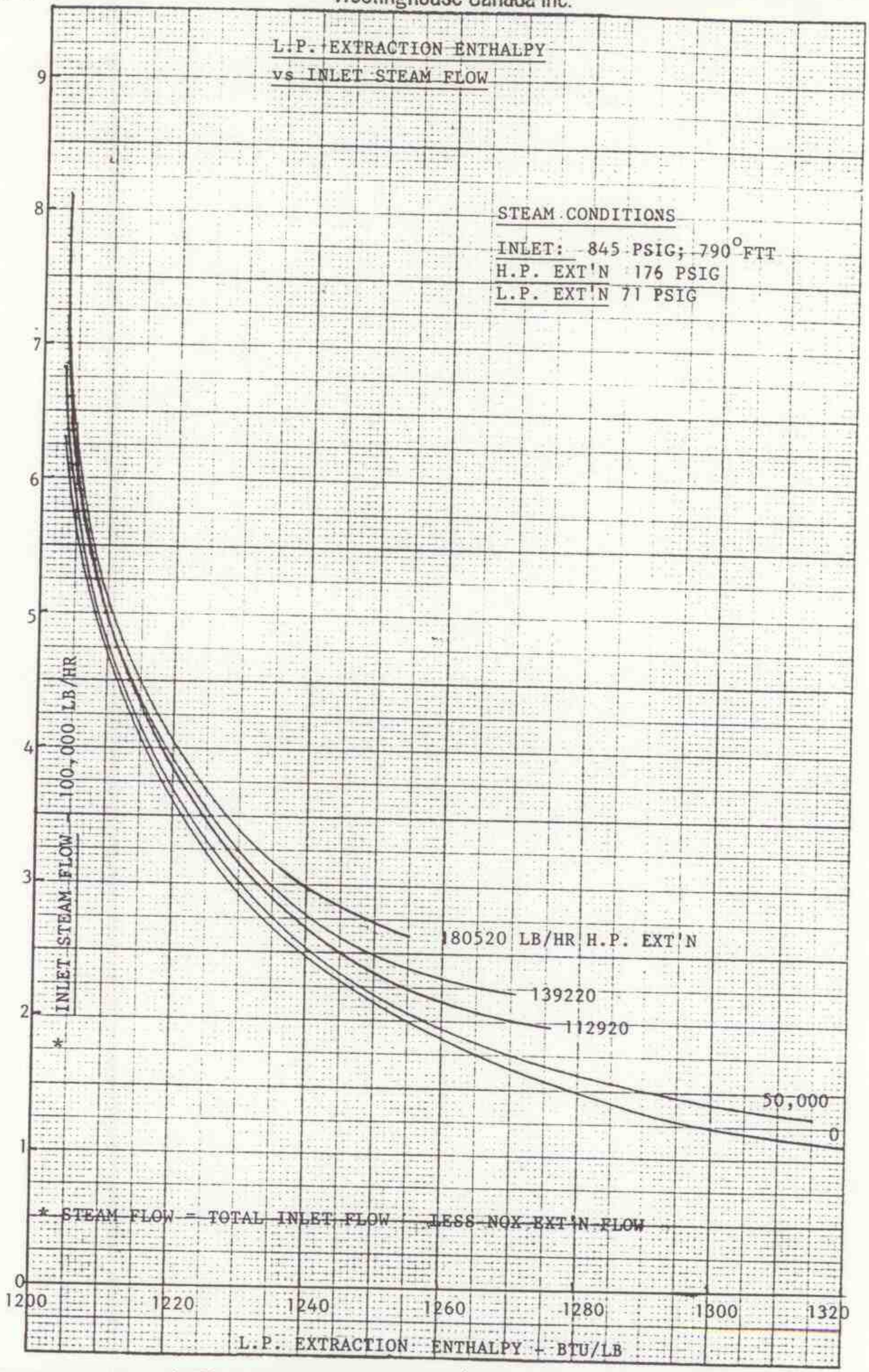

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