

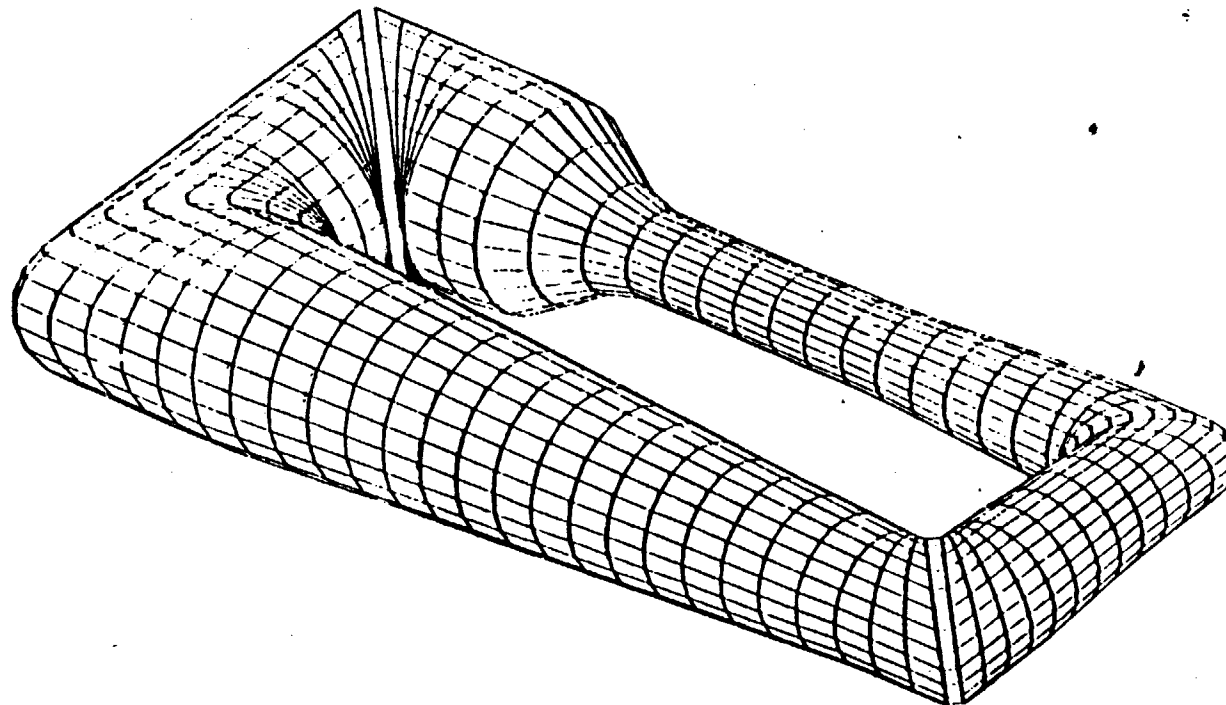
AWT CIRCUIT AEROTHERMODYNAMICS DISCUSSION

LOUIS A. POVINELLI
HEAD, TURBINE AERODYNAMICS SECTION
NASA LEWIS RESEARCH CENTER

457
N92-20492
7-11-92
393

LEWIS RESEARCH CENTER

ALTITUDE WIND TUNNEL PROJECT



PERFORMANCE ASSESSMENT AND MODELING TASK FORCE

CIRCUIT AEROTHERMODYNAMICS TASK TEAM

AWT PROJECT MODELING/DESIGN/CONSTRUCTION INTERFACES

PER

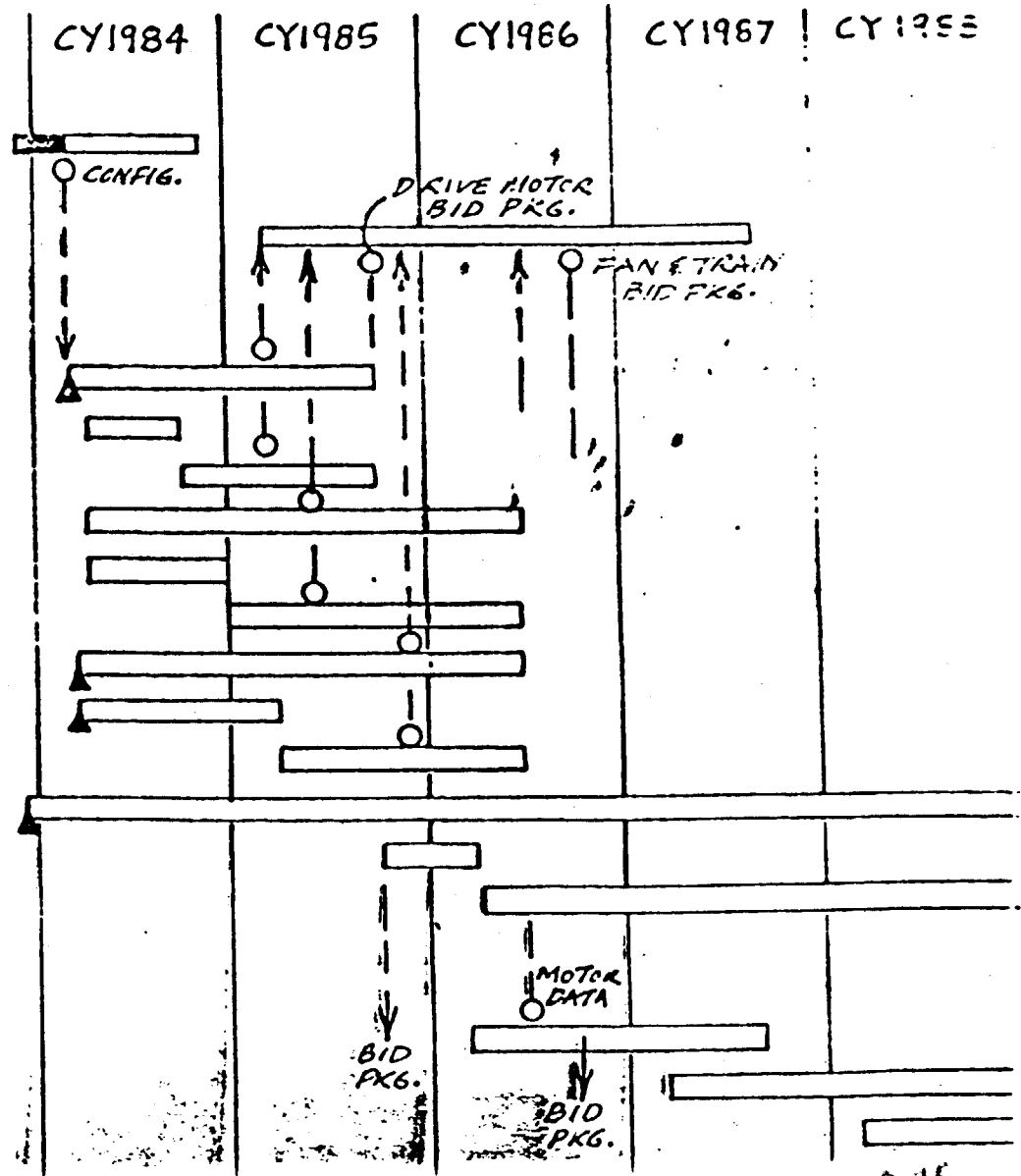
FINAL DESIGN

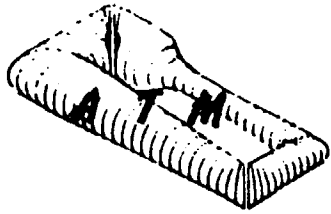
MODELING

- COMPONENTS - ANALYSIS
- TEST DESIGN & FAB.
- DATA
- HI-SPEED LEG - ANALYSIS
- TEST DESIGN & FAB.
- DATA
- FAN - ANALYSIS
- TEST DESIGN & FAB
- DATA
- FULL CIRCUIT - ANALYSIS
- TEST DESIGN & FAB.
- DATA

CONSTRUCTION

- DRIVE MOTOR & CONTROLS
- FAN FAB., ASSEM. & INSTALL.
- SHELL MODS & INTERNALS





ALTITUDE WIND TUNNEL PROJECT

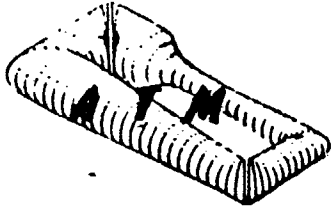
NASA
LEWIS

CIRCUIT AEROTHERMODYNAMICS TASK TEAM

Objective: To assess the aerothermodynamic performance of the baseline (PER) design and to define proper component and system configurations to insure desired tunnel flow quality

Approach: Utilize existing or modified computer codes to assess aerothermodynamic performance

§ 10.2.25
Verify aerothermodynamic performance through experimental model testing of components, coupled components, complete circuit, and research models.



ALTITUDE WIND TUNNEL PROJECT

CIRCUIT AEROTHERMODYNAMICS TASK TEAM

Leader - Lou Povinelli

Don Boldman

Bob Friedman

Tom Gelder

Joe Gladden

Doug Harrington

John Marek

Pete Meitner

Eric McFarland

Harvey Neumann

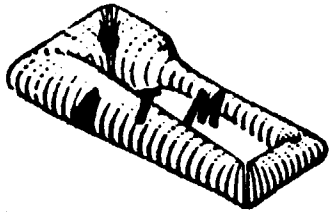
Charles Towne

Jim Van Fossen

CIRCUIT AEROTHERMODYNAMICS
MODELING PROGRAM

WORK BREAKDOWN STRUCTURE

- 2.1 CIRCUIT AEROTHERMODYNAMICS
 - 2.1.1 ANALYTICAL MODELING
 - 2.1.2 DESIGN AND FABRICATION
 - 2.1.3 PHYSICAL MODELING
 - 2.1.3.1 TURNING VANE #3/#4 MODEL
 - 2.1.3.2 TURNING VANE #1 MODEL
 - 2.1.3.3 HIGH SPEED LEG MODEL
 - 2.1.3.3.1 HIGH SPEED LEG & #1 & #4 CORNER MODEL
 - 2.1.3.3.2 HIGH SPEED LEG & #1, #3, #4, & HEAT EXCHANGER MODEL
 - 2.1.3.4 HEAT EXCHANGER MODEL
 - 2.1.3.5 CIRCUIT OR COMPLETE LOOP MODEL



ALTITUDE WIND TUNNEL PROJECT

CIRCUIT AEROTHERMODYNAMICS TASK TEAM

AERODYNAMIC MODELING

<u>SECTION</u>	<u>CODES</u>	<u>COMMENTS</u>
BELLMOUTH	VISTA, NAP PEPSIG*	AXISYMMETRIC FLOW TRANSITION TO OCTAGON
TEST SECTION	VISTA, ADD PAMPER NASPROP - E*	AXISYMMETRIC FLOW, UNIFORM BLEED AS ABOVE, + EMPIRICAL PROP EFFECTS
	PEPSIG*	INVISCID, CIRCULAR CROSS-SECTION, UNIFORM BLEED SLOTS, CIRCULAR CROSS-SECTION
	PEPSIG*	SLOTS, OCTAGONAL CROSS-SECTION
	PEPSIG*	FLOW IN PLENUM
MAIN DIFFUSER	VISTA, ADD, PEPSIM PEPSIG*	AXISYMMETRIC FLOW, SWIRL TRANSITION FROM OCTAGON, VORTEX GENERATORS



ALTITUDE WIND TUNNEL PROJECT

**NASA
LEWIS**

CIRCUIT AEROTHERMODYNAMICS TASK TEAM

CORNERS

PEPSIG
PANEL

NO VANES, GENTLER BEND, NO FAN HARDWARE
QUASI 3-D CASCADE, 2-D POTENTIAL GLOW
PANEL METHOD

ROTOR VISC
MINT
PEPSIG*

2-D CASCADE, NAVIER-STOKES
2-D CASCADE, NAVIER-STOKES
VANES REPRESENTED BY BODY FORCES FROM
NAVIER-STOKES RUN

BACK LEG

VISTA, ADD,
PEPSIM

AXISYMMETRIC FLOW, SWIRL,
TAIL CONE FAIRING

SIDE LEGS

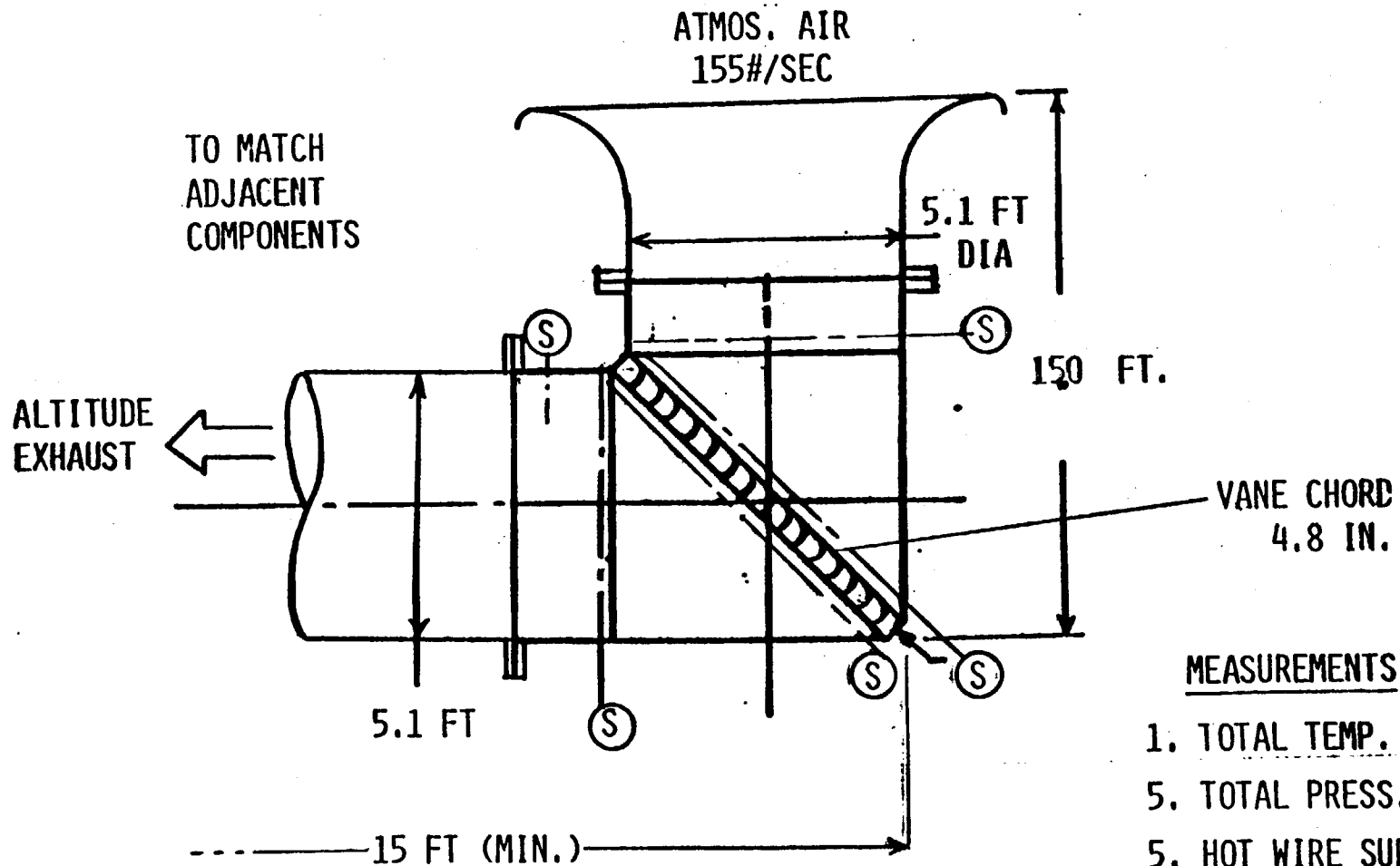
VISTA, ADD
PEPSIG*

AXISYMMETRIC FLOW
3-D INITIAL PROFILES

*REQUIRES CODE MODIFICATION

2.1.3.1 TURNING VANE MODEL # 3 AND # 4

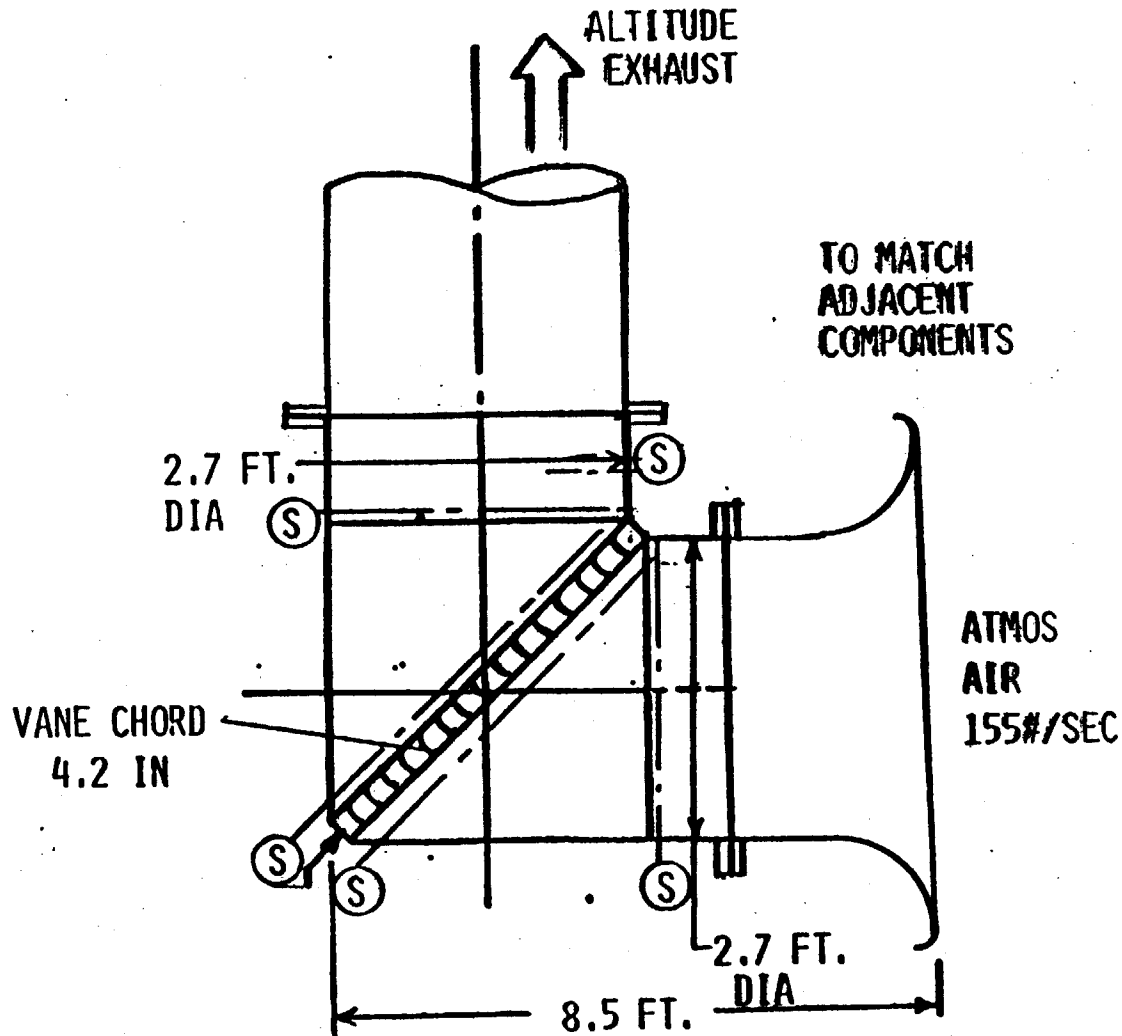
(2 REQUIRED)



MEASUREMENTS

1. TOTAL TEMP. SURVEY
5. TOTAL PRESS. SURVEYS
5. HOT WIRE SURVEYS
5. ANGULARITY SURVEYS
75. STATIC WALL TAPS
- (S) SURVEY LOCATION

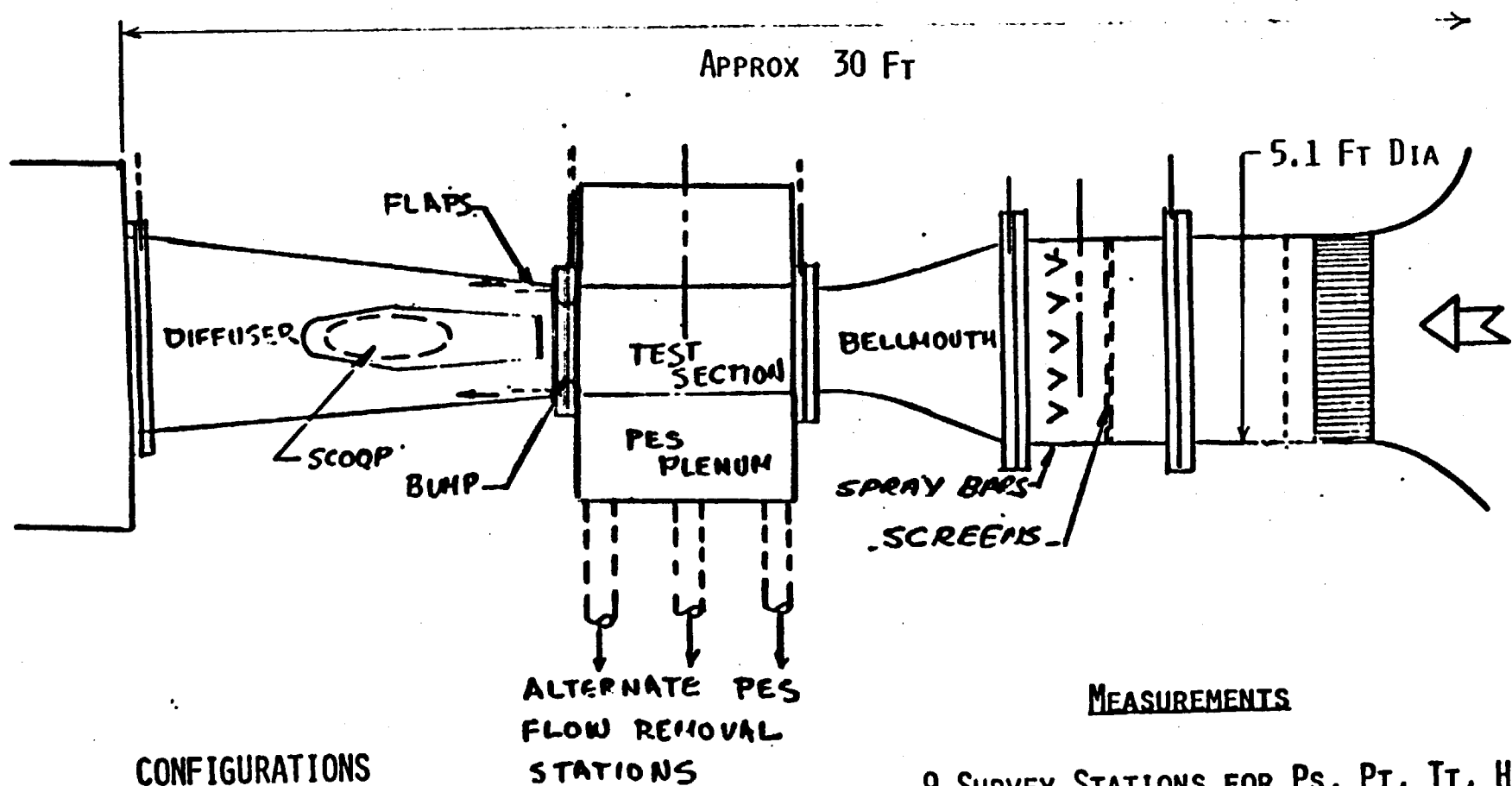
2.1.3.2 TURNING VANE MODEL # 1



MEASUREMENTS

- 1. TOTAL TEMP. SURVEY
- 5. TOTAL PRESS. SURVEYS
- 5. HOT WIRE SURVEYS
- 5. ANGULARITY SURVEYS
- 7/5. STATIC WALL TAPS

2.1.3.3 HIGH SPEED LEG MODEL



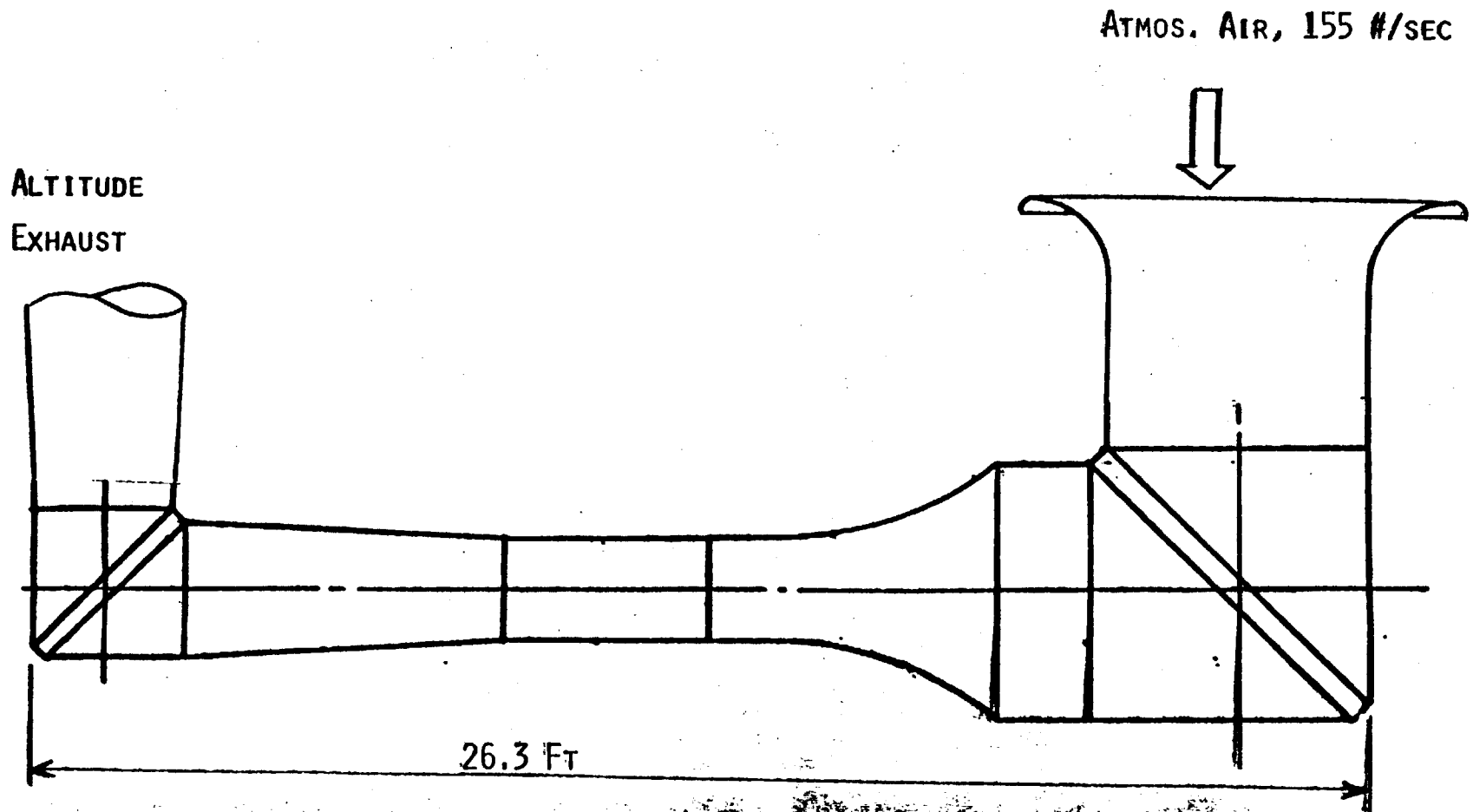
- 8 BELLMOUTHS, SCREENS, & SPRAYS
- 3 TEST SECTION P.E.S.
- 4 SLOTS 2 FLAPS
- 2 SCOOPS 1 CHOKE DEVICE
- 1 PARTRIDGE-IN-A-PEARTREE

- 9 SURVEY STATIONS FOR P_s , P_t , T_t , HOT WIRE, AND ANGULARITY
- 10 TOTAL PRESSURE
- 555 WALL STATIC PRESSURES

2.1.3.3.1 HIGH SPEED LEG, #1, AND #4 TURNING VANE MODEL

MEASUREMENTS

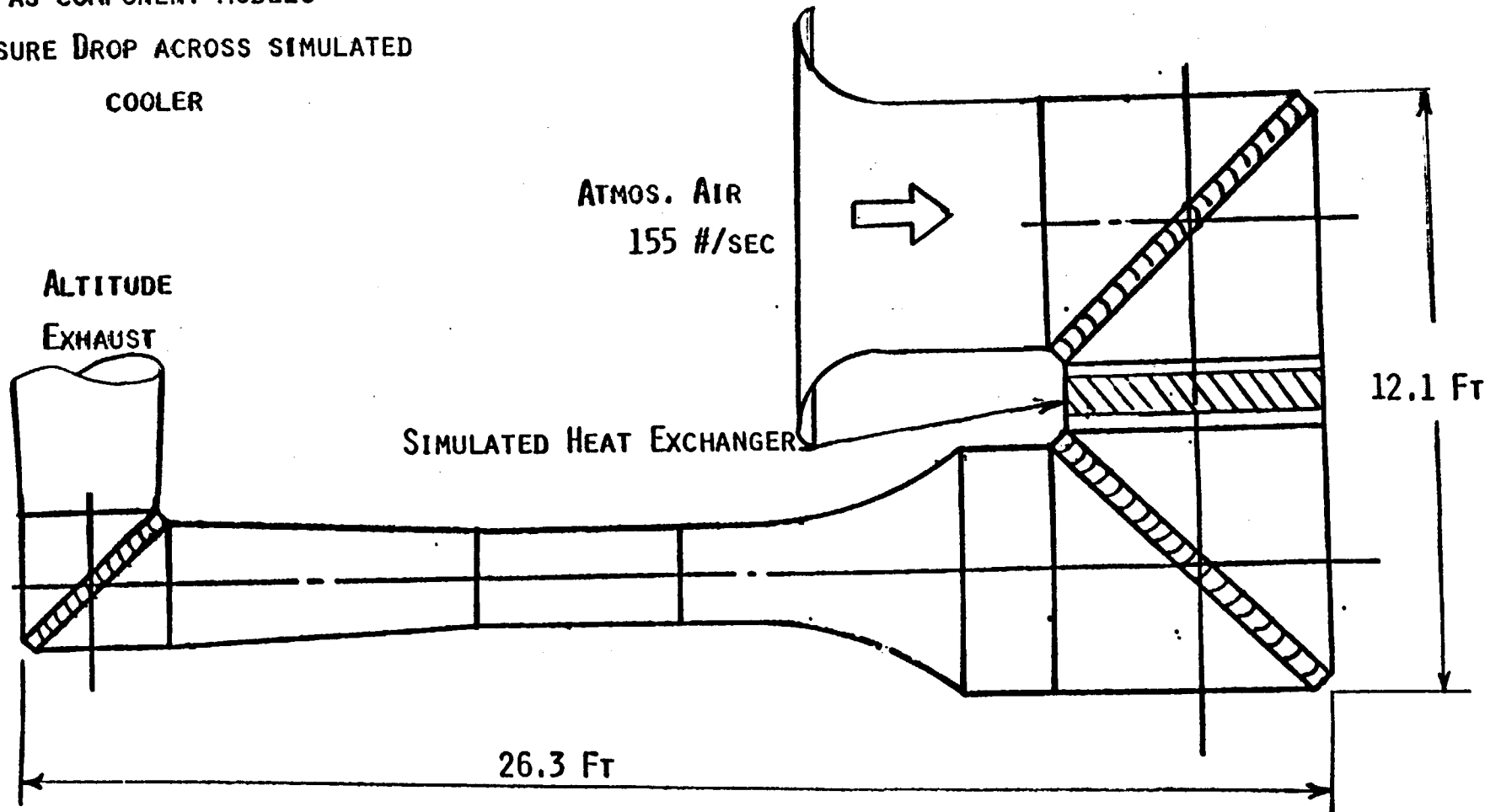
SAME AS COMPONENT MODELS



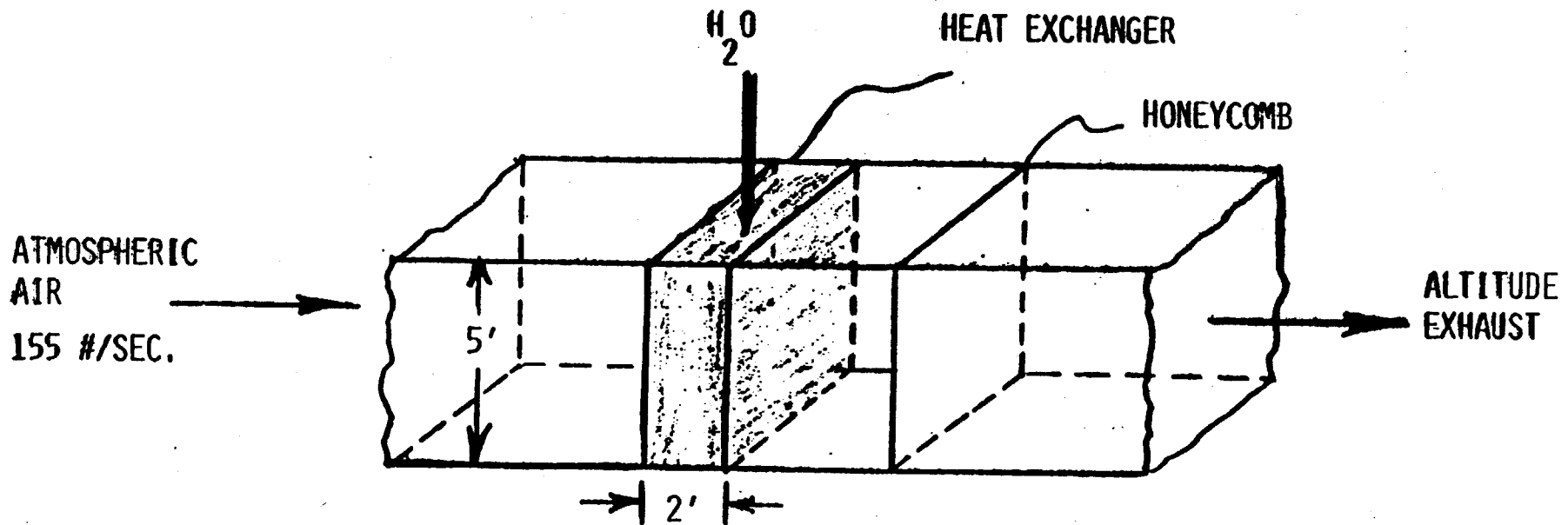
2.1.3.3.2 HIGH SPEED LEG, #3, #4, AND COOLER MODEL

MEASUREMENTS

SAME AS COMPONENT MODELS
PRESSURE DROP ACROSS SIMULATED
COOLER



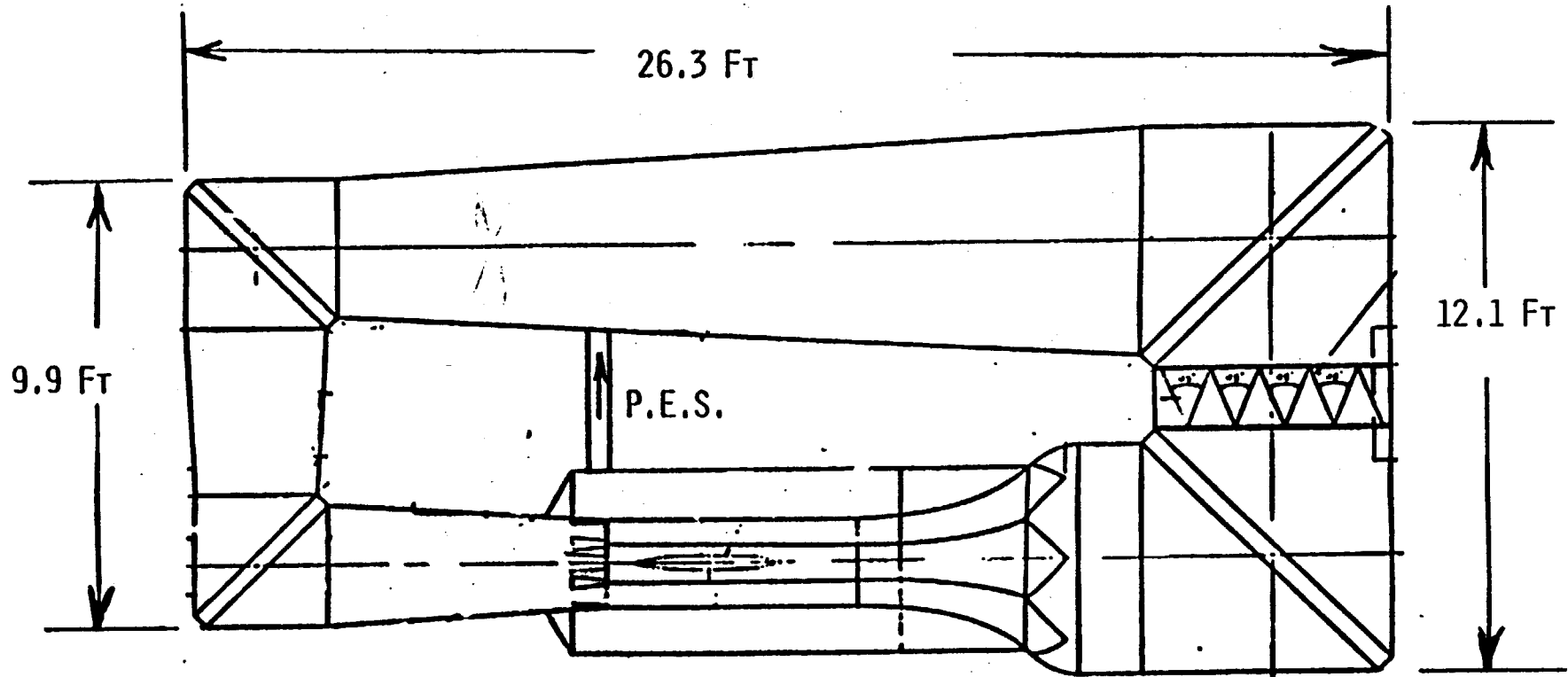
2.1.3.4 HEAT EXCHANGER MODEL



MEASUREMENTS

- 3 PRESSURE SURVEY STATIONS
- 2 TEMPERATURE " "
- 3 ANGULARITY " "
- 3 HOT WIRE " "
- 100 STATIC PRESSURES

2.1.3.5 CIRCUIT MODEL



MEASUREMENTS

SAME AS COMPONENTS

PES FLOW RATE

PES PRESSURE DROP

