



AEROSPACE RECOMMENDED PRACTICE

ARP755

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Cancelled 2014-02

Superseded by AS755

Aircraft Propulsion System Performance Station
Designation and Nomenclature

RATIONALE

ARP755 is hereby cancelled and is superseded by Aerospace Standard AS755. In the decades since its original publication, ARP755 has become one of the most widely used and followed Aerospace Recommended Practices among gas turbine engine industry organizations. Consistent identification of station locations and nomenclature are fundamental in facilitating and maintaining effective communication between engine manufacturers and customers. The definitions provided by ARP755 have also become a basis for other gas turbine standards documents commonly used throughout the industry. Consequently, the S-15 committee considers that the relevance and importance of its use warrant its designation as an industry standard. In order to maintain the widely recognized SAE document number '755', the content of ARP755 is now published as an Aerospace Standard, AS755.

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of February 2014 and has been superseded by AS755. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by AS755. Cancelled specifications are available from SAE.

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1. SCOPE:

- 1.1 This SAE Aerospace Recommended Practice (ARP) provides performance station designation and nomenclature systems for aircraft propulsion systems and their derivatives.
- 1.2 The systems presented herein are for use in all communications concerning propulsion system performance such as computer programs, data reduction, design activities, and published documents.

2. REFERENCES:

There are no referenced publications specified herein.

3. STATION DESIGNATION:

The following station numbering system will be used to designate the points in the gas flow path that are significant to propulsion system performance definition.

For computer symbols in this document, the following convention will be used:

- a. Ø denotes the numeric symbol
- b. O denotes the alphabetic symbol

WARNING: This convention is reversed from ARP755A.

3.1 Basis of System:

The system provides for the consistent definition of the process being undergone by the gas, regardless of the type of engine cycle. The six main processes specifically isolated are:

- a. kinetic compression (inlet/diffuser)
- b. mechanical compression/work addition/fluidic compression (compressor/propeller)
- c. heat addition or exchange (combustor/augmentor/heat exchanger)
- d. mechanical expansion/work extraction (turbine)
- e. kinetic expansion (nozzle)
- f. mixing (mixer/ejector/eductor).

3.2 Primary Stream:

The station numbers required to identify the processes for the primary gas flow are:

- a. Ø Free stream air conditions
- b. 1 First station of interest to the engine manufacturer, e.g., propulsion system entrance or external/internal interface
- c. 2 First compressor front face
- d. 3 Last compressor discharge or burner entrance
- e. 4 Burner discharge or first turbine entrance
- f. 5 Last turbine discharge

3.2 (Continued):

- g. 6 Available for mixer, afterburner, etc.
- h. 7 Engine/exhaust nozzle interface
- i. 8 Exhaust nozzle throat
- j. 9 Exhaust nozzle discharge

Station numbers associated with missing processes should be eliminated. Numbers not used for processes identified in 3.2 should not be utilized for other processes.

3.3 Multiple Streams:

Extension of the primary flow numbering scheme to multiple streams (e.g., the bypass flow of a turbofan engine) is obtained by prefixing a digit to the numbers in 3.2.

- 3.3.1 Unity (1) will be used for the innermost bypass stream with each succeeding stream numbered in consecutive order to the outermost stream.

Examples: 12 First compressor front face tip portion (if different from Station 2)
13 End of compression of bypass flow
28 Second bypass stream exhaust nozzle throat

- 3.3.2 Previous practice has been to use a leading digit 9 to identify the second bypass stream or an ejector nozzle flow, with the digit 8 for a third bypass stream, etc. While consecutive numbering is preferred, the previous practice is still acceptable, since it might create less confusion in engines having multiple compressor stations in the primary stream.

Examples: 93 Compressor discharge in 2nd bypass stream
83 Compressor discharge in 3rd bypass stream

- 3.3.3 If, however, two or more flow paths are mixed, succeeding numbers will be consistent with the innermost stream. For example, primary flow numbers are to be used when primary flow is mixed with a bypass flow.

- 3.3.4 The first digit of the primary stream and the first two digits of additional streams will be numeric only.

- 3.3.5 Property values (or flow rates) for individual streams are always average (or total) quantities.

Where primary and bypass streams are differentiated by separate stations and there is a need to describe the average (or total) properties at a plane including both streams, an alphanumeric station will be created. This station will be coplanar with the primary and bypass stations and formed by appending a letter to the hub station identification.

3.3.5 (Continued):

Appendage of the letter A, e.g. 1A, is reserved to describe the combined properties of all the streams in that plane. For example, when stations 1 and 11 define the primary and bypass streams at the engine inlet interface, station 1A is defined as encompassing both stations 1 and 11.

More than two streams can be handled in a similar manner.

3.4 Intermediate Stations:

For identification of intermediate stations, numeric or, if necessary, alphabetic subdividers will be appended to the upstream station numbers in 3.2 and 3.3. The appended subdivider should, where possible, be limited to one additional digit which will be chosen to prevent duplication, and will be assigned in an ascending or alphabetic sequence which corresponds to the direction of flow.

When using numeric subdividers, the use of a decimal point separator is encouraged to avoid confusion with multiple stream designators. The use of a decimal point may be incompatible with some computer languages. In such a case, it may be omitted or replaced by some other distinguishable character. A station between a primary stream low and high pressure compressor could be shown as 2.5 (preferred), 25, 2_5 or 2\$5 for instance.

If the length of the station designator is restricted so as to make use of a separator character undesirable, an alphabetic subdivider would be appropriate for multiple stream propulsion systems. For example, a primary intermediate station between stations 1 and 2 for a bypass engine may be identified as 1B to avoid conflict with the innermost bypass duct first compressor front face tip section, station 12.

3.5 Propeller Stations:

Special considerations are involved for engines with propellers or propulsors. The engine manufacturer may not have responsibility for the propeller system. When data or cycle decks are furnished, the engine manufacturer may create station numbers without regard to the propeller. Propeller stations may, therefore, be distinct from those of the engine, while following the same general principles.

Propeller station designations should conform to the rules used for engines, but may contain the suffix "P". The propeller upstream station thus becomes 12P. For that portion of the airflow at the hub which also flows through the gas generator, the upstream station becomes 2P.

For intermediate stations in a counter-rotating propeller system, the station designations become 12xP and 2xP, respectively, where a numeral would be substituted for the embedded symbol "x". The downstream stations become 13P and 3P.

3.6 Rocket Stations:

Special considerations are also involved for airbreathing powerplants which make use of rocket components, such as ducted rockets or ejector ramjets. One powerplant manufacturer may not have responsibility for the entire system. Rocket stations may, therefore, be distinct from those of the airbreathing portion of the system, while following the same general principles.

Rocket station designations should conform to the rules used for engines, but may contain the suffix RK.

3.7 Figures:

Figure 1 shows how these conventions can be applied to various pusher or tractor propeller systems. Figure 2 shows examples of the application of this system to several typical gas turbine engine configurations. Figure 3 shows examples of this system applied to other aircraft propulsion systems.

4. NOMENCLATURE:

This nomenclature has been compiled to provide a uniform method of naming variables associated with airbreathing propulsion systems. Its use is encouraged for all communications involving propulsion system performance including computer programs.

There are two columns of symbols. The first column presents the recommended symbols for general use and is restricted to upper case letters to be compatible with the computer. The second column presents alternate symbols which are retained because of their widespread use. Lowercase letters, subscripts and superscripts, Greek letters and other specialized characters have been avoided in the recommended symbols.

4.1 Basic Symbols:

This section includes the symbols used to derive basic parameters and will normally form the leading letter, or letters, in compound groups. Most of these symbols will be expanded by the addition of a station number, component symbol or stream identification as contained in later paragraphs. Examples of some resulting compound groups are contained in Section 5.

4.1.1 Properties and Fundamental Parameters: Please note that in all sections of this document the alternate form of the symbol is in parentheses.

Area, geometric	A
Altitude (Geopotential pressure)	ALT
Angle	ANG (AN, α , β , γ , etc.)
Density	RHO (ρ)
Efficiency, adiabatic	E (η , ETA)
Enthalpy - total per unit mass	H
Entropy - total per unit mass	S
Force, Thrust	F
Frequency	FY (f)
Heat Transfer Rate	QU (Q)

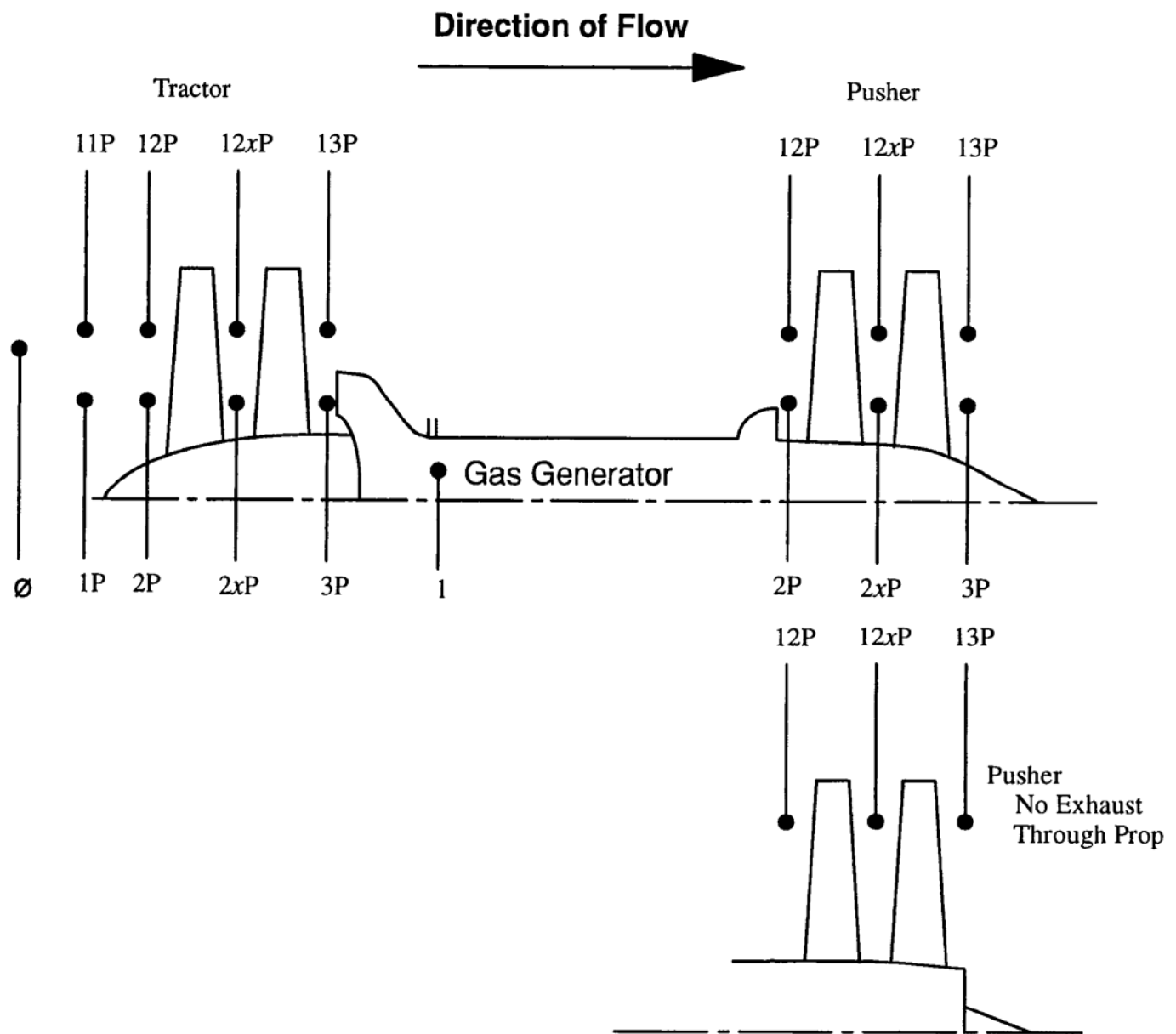


FIGURE 1 - Propeller/Propfan/UDF/Ultra-Bypass/Ultra-High
Bypass Station Designations
(Reference Section 3)

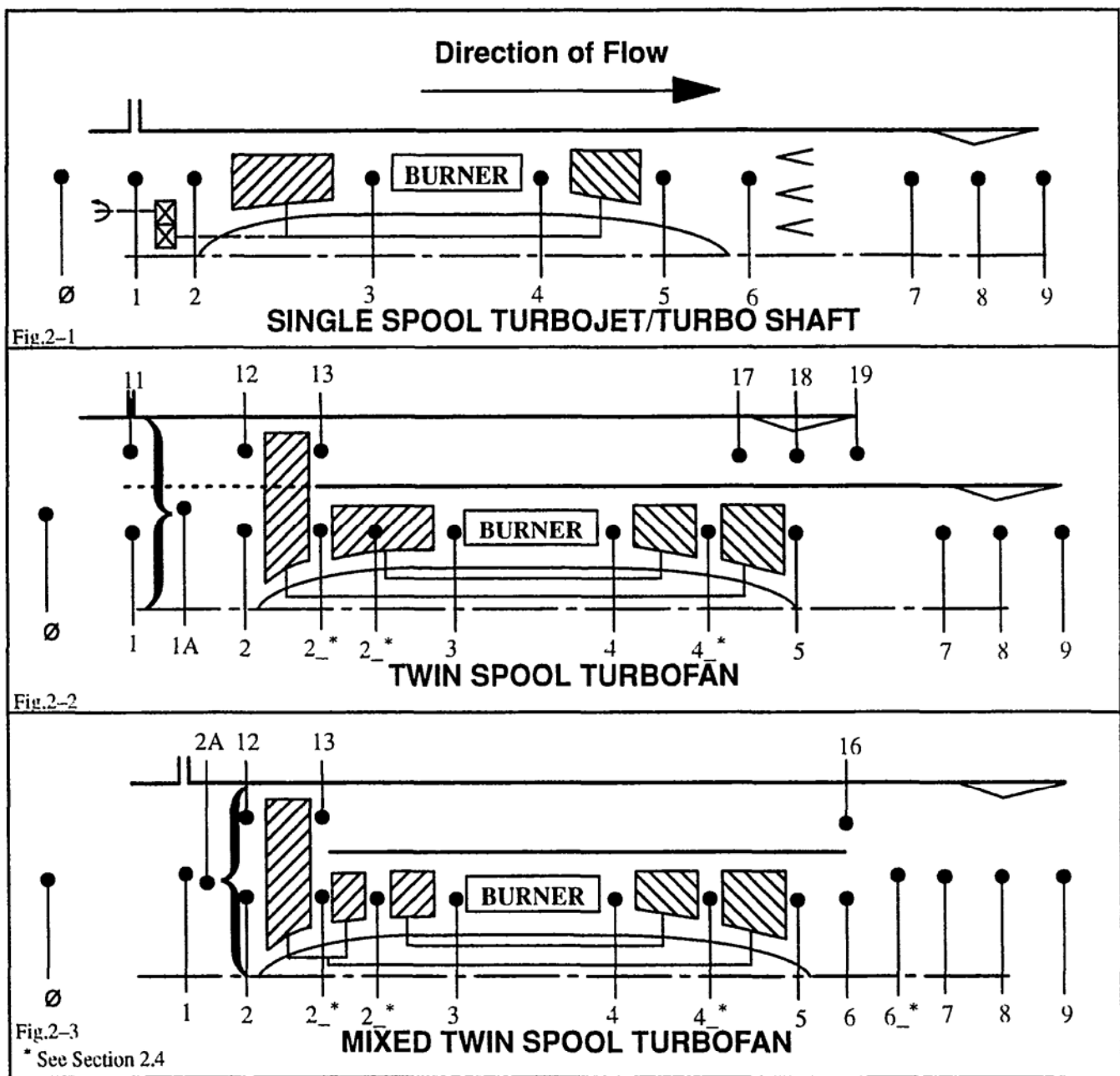


**FIGURE 2 - Examples of Station Designation for Gas Turbine Engines
(Reference Section 3)**