



AEROSPACE INFORMATION REPORT

AIR6508™

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Supplemental Propulsion System Performance Station Designation

RATIONALE

Aircraft propulsion technology continues to evolve and advance to meet changing requirements and challenges for improved performance and capabilities. This continuing evolution leads to increasingly complex and unconventional propulsion cycles not yet standardized within industry to a level of those presented in AS755. An industry desire to provide supplemental information on station numbering and nomenclature descriptions for these unconventional cycles has emerged.

AIR6508 has been reaffirmed to comply with the SAE Five-Year Review policy.

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Documents

Document Sharing Hub

Table 1 TBCC and/or scramjet station number definitions 9

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Table 3 PGC device and component nomenclature 10

Table 4 Useful quantities for unsteady combustion 11

1. SCOPE

This SAE Aerospace Information Report (AIR) supplements the AS755 performance station designation system for complex or unconventional propulsion cycles and their derivatives.

The station numbering conventions presented herein are for use in all communications concerning propulsion system performance such as computer programs, data reduction, design activities, and published documents. They are intended to facilitate calculations by the program user without unduly restricting the method of calculation used by the program supplier.

The contents of this document will follow AS755 and AS6502 where applicable.

The list of symbols presented herein will be used for identification of input and output parameters. These symbols are not required to be used as internal parameter names within the engine subprogram.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS755	Aircraft Propulsion System Performance Station Designation
AS6502	Aircraft Propulsion System Performance Nomenclature
ARP5571	Gas Turbine Engine Performance Presentation and Nomenclature for Object-Oriented Computer Programs

2.2 JANNAF Publications

Available from Joint Army Navy NASA Air Force Interagency Propulsion Committee, JHU CPIAC 10630 Little Patuxent Parkway Suite 202 Columbia, MD 21044-3286, <http://www.jannaf.org/>.

JANNAF-GL-2013-01 JANNAF Pressure Gain Combustion Guidelines

3. EXTENDED STATION NUMBERING

AIR6508 describes station numbering and nomenclature for additional cycles or modeling growing in use within the industry. The cycle types currently described within this document are the following:

- Gas turbine cycles with pressure gain combustion
- Gas turbine cycles integrated with other systems
- Closed gas turbine cycle
- Electric and hybrid electric systems
- Mode-dependent variable cycles
- Turbine-based combined cycles

3.1 Pressure Gain Combustion

Pressure gain combustion (PGC) can be integrated with conventional gas turbine cycles in multiple ways. JANNAF-GL-2013-01 describes a pressure gain combustion turbine engine (PGCTE) as any type of turbine engine that has some heat addition provided by a pressure gain combustor. Possible PGC components include the main burner, the afterburner, a duct burner, or any combination of these components. Figure 1 shows one example from JANNAF-GL-2013-01 of a turbofan where the traditional burner has been replaced with a PGC. In PGCTE cycles, the PGC initiator is treated as an additional mass flow stream, where the stream number is incremented above that of the cycle's traditional streams.

The PGC stations are as follows:

*3 Initiator chamber entrance (or *30, in alternative numbering)

*4 Initiator chamber exit (or *40)

*8 Initiator exit throat (or *80)

* Next available multiple stream designation.

More information on pressure gain combustion, associated station numbering, and nomenclature can be found in JANNAF-GL-2013-01.

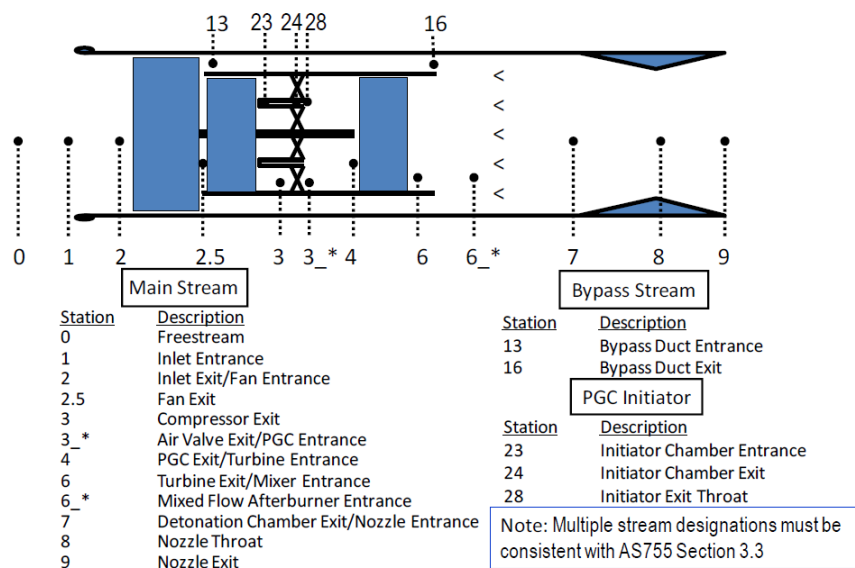


Figure 1 - PGCTE example

Given the inherent non-steady state process of PGC, fluid properties at these stations vary in time as the process occurs; i.e., a station's gas properties will not be constant at an operating condition. When modelling a PGCTE, properties at each condition (e.g., unburned, detonated, and exhaust gases) must be determined. Future revisions will provide guidance on modelling this phenomenon, while maintaining consistency with other stations within the cycle.

3.2 Multi-System Integration

In many cases, the gas turbine engine has become integral with other vehicle systems. Whenever a component is part of multiple systems (or subsystems), care must be taken to ensure the station numbering of the component(s) remains consistent with conventional gas turbine station numbering and distinct with the other system(s).