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भारतीय मानक मसौदा

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भाग 4 वायुगतिकी

(पहला पुनरीक्षण)

Draft Indian Standard

**GLOSSARY OF AERONAUTICAL AND ASTRONAUTICAL TERMS
PART 4 AERODYNAMICS**

(First Revision)

ICS: 49.020

**Air and Space Vehicles Sectional Committee, Last date for receipt of comments is
TED 14 XX/XX/XXXX**

FOREWORD

(Formal Clause to be added later)

This standard is one of a series of Indian Standards on the glossary of Aeronautical and Astronautical terms. Other standards in this series are:

- | | |
|-------------------------|---|
| IS 7879 (Part 1) : 1975 | Glossary of Aeronautical and Astronautical Terms: Part 1 General |
| IS 7879 (Part 2) : 1975 | Glossary of Aeronautical Terms: Part 2 Motion Of Aircraft |
| IS 7879 (Part 3) : 1975 | Glossary of Aeronautical and Astronautical Terms: Part 3 Structure |
| IS 7879 (Part 5) : 1982 | Glossary of Aeronautical and Astronautical Terms: Part 5 Aerodynes
(Heavier - Than - Air - Aircraft) |

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- IS 7879 (Part 6) : 1978 Glossary of Aeronautical and Astronautical Terms: Part 6 Space Terms
- IS 7879 (Part 7) : 1984 Glossary of Aeronautical and Astronautical Terms: Part 7 Air Traffic
And Ground Services
- IS 7879 (Part 8) : 1987 Glossary of Aeronautical and Astronautical Terms: Part 8 Power Plant

The present standard provides standard definitions of technical terms peculiar to aeronautics, astronautics and related subjects. Terms in general use in other branches of engineering are also included where they have some special relevance to aeronautics or astronautics. The other parts of the standard cover terms specific to a particular feature, type of aircraft, equipment and services.

The general arrangement of the terms is alphabetical. However, in certain cases the relative terms have been given together under a heading or general definition. Where two or more synonymous terms are in use, the term which is favored is given first with the intention that it should gradually displace the others. The alternative terms are given in parenthesis.

Each term has been assigned a 4-digit or 5-digit number. The first one (or two) digit, in the thousandth place, represents the part number. This part number with the following digit in the hundredth place represents the section. The last two digits represent the position of the definition within a section. Thus, the term 4215 is the 15th definition of section 42 which is in Part 4.

This standard was first published in 1982. The present revision has been taken up with a view to incorporating the modifications found necessary as a result of experience gained on the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standard, and references to Indian Standards, wherever applicable have been updated.

The following International Standards available on the subject have been referred by the technical committee in the course of preparation of this standard:

- a) BS 185 ‘Aeronautical and Astronautical terms’.

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Draft Indian Standard

**GLOSSARY OF AERONAUTICAL AND ASTRONAUTICAL TERMS
PART 4 AERODYNAMICS**

(*First Revision*)

1 SCOPE

This part covers the standard definitions for terms relating to aerodynamics.

2 REFERENCES

This standard does not contain any cross reference.

3 TERMINOLOGY

SECTION 41 GENERAL

No.	Term	Definition
4101	Aerodynamic Centre	The point about which the rate of change of pitching moment with incidence is zero.
4102	Aerodynamic Twist	Variation of the zero-lift line along the span of a wing or other aerofoil.
4103	Airspeed	The speed of an object relative to the ambient undisturbed air.
	Angles	
4104	Angles Angle of Attack (Angle of Incidence)	The angle between a reference line in a body (for an (Angle of Incidence) aerofoil the chord is usually used) and the projection of the velocity relative to the ambient undisturbed air on to the plane symmetry NOTE — Not to be confused with rigging angle of incidence.
4105	Effective Angle of Attack	The angle between a reference line on a body and the mean direction of a non-uniform disturbed airstream ahead of the body.
4106	Angle of Downwash / Upwash	The angle between the projections on to the plane of symmetry of the local and undisturbed flow directions.

No.	Term	Definition
4107	Angle of Sideslip	The angle between the direction of the undisturbed flow and the plane of symmetry.
4108	Angle of Sidewash	The angle between the projections of the local and undisturbed flow directions on to a plane perpendicular to the plane of symmetry and parallel to the undisturbed flow.
4109	Area Rule, Sonic	The approximation that the wave drag at the speed of sound is the same for all bodies with the same longitudinal distribution of cross-sectional area. In particular, it is equal to that of a body of revolution of that area distribution.
4110	Area Rule, Supersonic	A method of estimating the wave drag in inviscid supersonic flow for smooth bodies in terms of the areas of sections taken obliquely at the Mach angle.
4111	Autorotation	Continuous rotation of a body resulting from the action of air forces and not sustained by control inputs.
	Axes	
4112	Body Axes	A system of rectangular co-ordinate axes fixed in the aircraft, usually with the origin at the centre of gravity. The x-axis is usually forward of and in (or parallel to) the plane of symmetry, the y-axis is to starboard, and the z-axis perpendicular to these so as to form a right handed system. The xz plane is generally a plane of symmetry.
4113	Aerodynamic-body axes (Wind-body Axes)	Body axes in which the x-axis coincides with (or is parallel to) the projection on to the plane of symmetry of some datum velocity of the origin relative to the ambient undisturbed air.
4114	Principal Body Axes	Body axes that coincide with the principal axes of inertia through the centre of gravity.
4115	Longitudinal Axis	Body axes that coincide with the principal axes of inertia through the centre of gravity.

No.	Term	Definition
4116	Normal Axis	The x-axis of a system of body axes in which the xz plane is the plane of symmetry.
4117	Transverse Axis (Lateral Axis)	The r-axis of a system of body axes in which the xz plane is the plane of symmetry.
4118	Cross-Wind Axis	The straight line through the centre of gravity perpendicular to the lift and drag axes. The positive direction is to port.
4119	Drag Axis	The straight line through the centre of gravity parallel to the direction of the undisturbed flow. The positive direction is downstream.
4120	Lift Axis	The straight line through the centre of gravity in the plane of symmetry and perpendicular to the drag axis. The positive sense is in the dorsal direction.
4121	Centre of Pressure	The point on some reference line (for example, the chord of an aerofoil) about which the pitching moment is zero.
	Drag	
4122	Cooling Drag	Drag associated with the cooling of the power plant, etc.
4123	Form Drag	For shock-free flow, the normal-pressure drag less the vortex drag.
4124	Lift-Dependent Drag	The difference between the drag at a given lift coefficient and the drag at some specified datum lift coefficient.
4125	Normal-Pressure Drag	Drag arising from the resolved components of the pressures normal to the surface.
4126	Post-Exit Drag	The force in the drag direction deduced from the resolved components of the normal pressure on the outside of the equivalent post-exit streamtube.
4127	Pre-Entry Drag	The force in the drag direction deduced from the resolved components of the normal pressure on the outside of the pre-entry streamtube.

No.	Term	Definition
4128	Profile Drag (Boundary-Layer Drag)	Drag associated with losses in total pressure in the boundary layers. It is the sum of the form drag and the skin-friction drag.
4129	Ram Drag	The force, acting in the downstream direction, which would arise if the momentum of the internal flow at infinity of a body were destroyed. It is the effective sink drag of an air intake.
4130	Sink Drag	Drag arising from the removal of fluid from the flow.
4131	Spillage Drag	The difference between the drag at a given intake flow and drag at some specified intake flow.
4132	Additive Drag	Additive drag is a component of the spillage drag occurring during subcritical flow of an intake. It is equal to the sum of the pressure forces acting parallel to the free stream direction over the diverging portion of the pre-entry stream tube.
4133	Skin-Friction Drag (Surface-Friction Drag)	Drag arising from the resolved components of the tangential forces on the surface of a body.
4134	Wave Drag (Shock-Wave Drag)	Drag arising from the formation of shock waves.
4135	Vortex Drag (Trailing-Vortex Drag)	Drag arising from the formation of trailing vortices. Formerly called induced drag.
4136	External Surface	A surface that forms a boundary of the external flow.
	Flows	
4137	Datum Intake Flow	The intake flow that would occur if the boundary of the pre-entry streamtube were unaffected by the presence of the intake.
4138	External Flow	The flow of fluid which passes around a body.
4139	Full Intake Flow	The intake flow that occurs when with a pre-entry compression body in position, the boundary of the pre-entry stream tube is unaffected by the presence of the remainder of the intake. If there is no pre-entry

No.	Term	Definition
		compression body, then full intake flow is the same as datum intake flow.
4140	Internal Flow	The flow of fluid which passes through a duct of a body.
	Forces	
4141	Cross-wind Force	The component of the total aerodynamic force in the direction of the cross-wind axis.
4142	Drag	The component of the total aerodynamic force in the direction of the undisturbed flow. In powered flight, contributions to this component arising from thrust are excluded.
4143	Lift	The component of the total aerodynamic force in the direction of the lift axis.
4144	Longitudinal Force (Axial Force)	The component of the total aerodynamic force along the x-axis (or longitudinal axis).
4145	Normal Force	The component of the total aerodynamic force along the x-axis (or normal axis).
4146	Transverse Force (Lateral Force) / (Side Force)	The component of the total aerodynamic force along the y-axis (or transverse axis).
4147	Thrust	The aerodynamic force attributed to the propulsive system.
4148	Post-exit Thrust	The force in the direction of motion deducted from the resolved components of the normal pressures on the inside of the Post-exit stream tube.
4149	Pre-entry Thrust	The force in the direction of motion deducted from the resolved components of the normal pressures on the inside of the pre-entry stream tube.
4150	Ground Effect	The effect of the proximity of the ground or other surface on the aerodynamic characteristics of an aircraft.
4151	Hinge Moment	The moment about the hinge axis of a control or other hinged surface due to aerodynamic forces.

No.	Term	Definition
4152	Industrial Aerodynamics	Aerodynamics of non-aeronautical engineering applications, such as buildings, bridges, stacks, vehicles, duct flows, fans, ventilation, combustion.
4153	Interference	The aerodynamic influence of bodies on one another.
4154	Infernal Surface	A surface that forms a boundary of the internal flow.
4155	Limiting Velocity	The maximum steady velocity attainable by an aircraft along a straight flight path at any specified angle to the horizontal under given atmospheric and propulsive conditions.
4156	Post-exit Stream tube	The hypothetical stream tube, extending from the body to infinity downstream, that is assumed to separate the internal flow from the external flow in the absence of mixing.
4157	Pre-entry Stream tube	The stream tube extending to the entry of a ducted body from infinity up-stream and separating the internal flow from the external flow.
4158	Scale Effect	The effect upon any non-dimensional aerodynamic coefficient of a change in the size of a body, other conditions remaining unchanged. More generally, the effect of a change in the Reynolds number.
4159	Sound Barrier	A popular term for the large changes in the aerodynamic characteristics of an aircraft approaching the speed of sound, formerly believed to make super-sonic flight unattainable.
4160	Spillage	The amount by which the intake flow is less than some specified intake flow.
4161	Stall	The progressive breakdown of attached flow over an aerofoil, leading to marked changes in aerodynamic characteristics, in particular loss of lift [<i>see</i> term 2231 in IS 7879 (Part 2) : 1975 'Glossary of aeronautical and astronautical terms: Part 2 Motion of aircraft'].
4162	Terminal Velocity	a) The highest value of the limiting velocity; and

No.	Term	Definition
		b) The velocity for which the drag of a freely falling body just balances the weight at a given altitude.
4163	Vertical Thrust Margin (VTM)	The amount, on a VTOL aircraft, by which the vertical thrust exceeds the aircraft weight.
4164	Zero-Lift Line	A line through the trailing edge of an aerofoil section parallel to the direction of the relative air stream when the lift is zero.
SECTION 42 STABILITY AND CONTROL		
4201	Aerodynamic Damping	That part of the damping of a system which is contributed by the aerodynamic forces and/or moments called into play by the motion.
4202	Aerodynamic Stiffness	That part of the stiffness of a system which is contributed by the aerodynamic forces and moments called into play by the motion.
4203	Disturbance	A displacement from steady state conditions.
4204	Divergence	A disturbance which increases without oscillation (<i>see</i> 4234).
4205	Lateral Divergence	A divergence involving rolling, yawing, sideslipping or any combination of these.
4206	Longitudinal Divergence	A divergence in the plane of symmetry.
4207	Spiral Divergence (Spiral Instability)	A lateral divergence which tends to a spiral descent with increasing rate of turn.
4208	Instability	The quality whereby any disturbance from steady motion tends to increase. An aircraft is unstable, if following a disturbance from a given type of steady motion, it does not return to its initial steady motion without movement of the controls by the pilot (<i>see</i> 4223).
Motions		

No.	Term	Definition
4209	Lateral Motion	Motion involving rolling, yawing, sideslipping or any combination of these.
4210	Longitudinal Motion	Motion in the plane of symmetry.
4211	Coupled Motion	Motion of an aircraft involving both lateral and longitudinal motion at the same time.
4212	Inertia Coupling	Coupled motion due to the inertial properties of the aircraft.
4213	Manoeuvre Margin with Stick Fixed	The distance of the centre of gravity, forward of the manoeuvre point with stick fixed, expressed as a fraction of the longitudinal reference dimension. It is a measure of the displacement of the control column necessary to produce a given normal acceleration in a steady pull-out.
4214	Manoeuvre Margin with Stick Free	The distance of the centre of gravity forward of the manoeuvre point with stick free, expressed as a fraction of the longitudinal reference dimension. It is a measure of the force in the control column necessary to produce a given normal acceleration in a steady pull-out.
4215	Manoeuvre Point with Stick Fixed	The position of the centre of gravity for which the displacement of the control surface required to maintain a steady normal acceleration does not depend on the acceleration.
4216	Manoeuvre Point with Stick Free	The position of the centre of gravity for which the force on the control column required to maintain a steady normal acceleration does not depend on the acceleration.
4217	Neutral Point with Stick Fixed	The centre of gravity position for which the static margin with stick fixed is zero.
4218	Neutral Point with Stick Free	The centre of gravity position for which the static margin with stick free is zero.
	Oscillations	

No.	Term	Definition
4219	Lateral Oscillation	An oscillation involving rolling, yawing, sideslipping, or any combination of these.
4220	Longitudinal Oscillation	An oscillation in the plane of symmetry.
4221	Phugoid Oscillation	The long-period longitudinal oscillation involving predominantly changes in airspeed.
4222	Short-Period Longitudinal Oscillation	An oscillation, in which the aircraft's forward speed remains substantially constant, involving predominantly changes in incidence and attitude. It is so called because the period is usually, but not necessarily, small compared with that of the phugoid.
4223	Stability	The quality whereby any disturbance of steady motion tends to decrease. A given type of steady motion is stable if the aircraft will return to that state of motion after disturbance without movement of the controls by the pilot (<i>see</i> 4208).
4224	Directional Stability	Stability of motion involving yawing, sideslipping or any combination of these.
4225	Dynamic Stability	Complete stability of motion when aerodynamic forces, gravity and inertial are all taken into account. It is also the time history of the moments of a body in response to its static stability tendencies following an initial disturbance from equilibrium.
4226	Lateral Stability	Stability of motion involving rolling, yawing, side slipping or any combination of these.
4227	Longitudinal Stability	Stability of motion in the plane of symmetry.
4228	Static Stability	Stability when only aerodynamic stiffness is taken into account. It is also the initial tendency of the body to return to the equilibrium attitude following a disturbance.
4229	Weathercock Stability	The tendency of a body to turn into the relative wind.
4230	Stability Derivatives	Quantities expressing the rate of change of the aerodynamic forces and moments with respect to changes in the components of velocity, angular velocity, etc.

No.	Term	Definition
4231	Static Margin with Stick Fixed	A measure of the stick movement required to produce a given change in the trim speed at constant lift or, more generally, at constant aerodynamic resultant force.
4232	Static Margin with Stick Free	A measure of the stick force required to produce a given change in the trim speed at constant lift or, more generally, at constant aerodynamic resultant force.
4233	Stick Force per g	The increase in force on the control column exerted by the pilot to produce an increase in normal acceleration of 1 g.
4234	Subsidence	A disturbance which decreases without oscillation (<i>see</i> 4204).
SECTION 43 PERFORMANCE		
Ceilings		
4301	Absolute Ceiling	The altitude at which the maximum rate of climb of an aircraft becomes zero in the international standard atmosphere under specified conditions.
4302	Service Ceiling	The altitude at which the maximum rate of climb of an aircraft has a defined value approximating to the lowest practicable for a service operation.
4303	Critical Point	That point between two positions from which it will take an aircraft equal time to reach either position.
4304	Cruise Climb (Drift up)	Slow ascent, due to the progressive reduction in weight from fuel consumption, at constant throttle setting and constant Mach number.
4305	Cruising Threshold	The equivalent airspeed giving the lowest acceptable continuous cruising speed.
4306	Drift Down	The gradual descent of an aircraft, from its normal cruise altitude to its cruise altitude at reduced power, following an engine failure.

No.	Term	Definition
4307	Endurance	The length of time an aircraft can continue flying under given conditions without refuelling.
4308	Prudent Limit of Endurance (PLE)	The time during which an aircraft can remain airborne and still retain a safety margin of fuel.
4309	Equivalent Head-(Tail) Wind	That wind which, blowing uniformly along the track of the aircraft, would result in the same duration of flight as the actual system of winds.
4310	Mach Number	The ratio of the airspeed to the speed of sound under prevailing atmospheric conditions (<i>see 4456</i>).
4311	Indicated Mach Number	The reading of a Machmeter corrected for instrument errors only.
4312	Performance	Those properties of an aircraft which determine its operational usefulness (that is, maximum speed, rate of climb, ceiling, range, all-up weight and runway length requirements).
4313	Position Error	That part of the difference between the rectified and indicated airspeeds due to the recorded static pressure not being equal to the ambient pressure. This discrepancy may arise from the location of the pressure head on the aircraft or the conditions of motion, or both.
	Pressure	
4314	Flight Pitot Pressure	The pitot pressure corresponding to the true airspeed of an aircraft under the prevailing atmospheric conditions.
4315	Pitot Pressure Error Correction	The correction that must be added to the pressure applied at the aircraft pitot pressure source to obtain the flight pitot pressure.
4316	Pressure Error	The error in a pressure measurement, such as pitot pressure or static pressure, due to the fact that the true pressure is not applied at the source.

No.	Term	Definition
4317	Static Pressure Error Correction	The correction that must be added to the pressure applied at the aircraft static pressure source to obtain the ambient static pressure.
4318	Radius of Action	The maximum distance an aircraft can travel away from its base along a given course with normal load and return without refuelling, allowing for all safety and Operating factors.
4319	Range	The range when an aircraft is continuously flown under conditions giving maximum fuel economy for the weight and prevailing wind.
4320	Most Economical Range	The distance an aircraft can travel under given conditions without refuelling.
4321	Still Air Range	The horizontal distance that can be flown for a given programme of speed and altitude in the international standard atmosphere in still air on the usable fuel remaining after starting, warming and running up the engines, taxiing and taking-off, excluding the distance in gliding from altitude at the end of the flight but including the distance in climbing to altitude at the best climbing speed at the start.
4322	Equivalent Still Air Range	The theoretical range of an aircraft at specified cruising altitude, true airspeed power and fuel carried. No allowance is made for engine run-up, taxiing, taking off, climbing, descending, landing, wind or reserve fuel.
4323	Rate of Climb	The vertical component of the true airspeed in stated conditions.
4324	Screen	An imaginary obstacle of specified height assumed in determination in take-off and landing performance.
	Speeds	
4325	Calibrated Airspeed (CAS) (Rectified Airspeed)	The airspeed which, under sea-level conditions in a standard atmosphere, would give the same impact pressure as that at the aircraft's location.

No.	Term	Definition
		NOTE — It can be obtained by correcting the airspeed indicator reading for position and instrument error.
4326	Equivalent Airspeed (EAS)	The product of the true airspeed and the square root of the ratio of the air density at the prevailing conditions to that at sea level in standard atmosphere.
4327	Ground Speed	The horizontal component of an aircraft's velocity relative to the earth's surface.
4328	Indicated Airspeed (IAS)	The reading of an airspeed indicator.
4329	Maximum Flying Speed	The maximum true airspeed of an aircraft in straight and level flight in the international standard atmosphere under specified conditions.
4330	Minimum Control Speed	The lowest possible speed of a multi-engined aircraft at which, at a constant power setting and aircraft configuration, the pilot is able to maintain a straight course after failure of one or more engines.
4331	Minimum Flying Speed	The minimum airspeed at which an aircraft can be maintained in straight and level flight in the international standard atmosphere under specified conditions.
4332	Take-Off Safety Speed	The lowest speed above the minimum flying speed at which, in the take-off configuration and after failure at take-off power of the engine most affecting control, a safe margin of control by the pilot is ensured.
4333	True Airspeed (TAS)	The speed of an aircraft relative to the ambient undisturbed air.
SECTIONS 44 AND 45 FLUID MOTION		
4401	Actuator Disc	A concept in the momentum theory of rotors, in which the rotor is treated as equivalent to an infinite number of elementary blades capable of producing a discontinuous, uniformly distributed pressure rise.
4402	Aerodynamic Heating (Kinetic Heating)	The heating of the surface of a body by virtue of its motion through a gas; it becomes significant at high speed.

No.	Term	Definition
4403	Boundary Layer	The thin layer of fluid adjacent to a surface, in which the viscous forces are dominant.
4404	Laminar Boundary Layer	A boundary layer in which the flow is laminar (<i>see</i> 4434).
4405	Laminar Sub-Layer (Viscous Sub-Layer)	A very thin layer of laminar flow in a boundary layer, next to the body and beneath a turbulent layer.
4406	Turbulent Boundary Layer	A boundary layer in which the flow is turbulent (<i>see</i> 4444).
4407	Boundary Layer Control	Control by artificial means of the development of the boundary layer with the object of affecting its transition or separation.
4408	Boundary Layer Blowing	Boundary layer control by injecting air or other gas into the boundary layer.
4409	Boundary Layer Suction	Boundary layer control by withdrawing air from the boundary layer.
4410	Area Suction	Boundary layer suction by withdrawing air through a porous or perforated surface.
4411	Slot Suction	Boundary layer suction by withdrawing air through a slot in the surface.
4412	Momentum Coefficient	A non-dimensional coefficient for boundary layer blowing. It is equal to the ratio of the product of the mass flow rate and the velocity of the ejected air or gas (often taken to be that attained after expansion to the static pressure in the undisturbed flow) to the product of the dynamic pressure of the undisturbed flow and a specified surface area. The surface area used for a wing may be only that portion of the area corresponding to the span wise extent of the boundary layer control.
4413	Jet-Reaction Coefficient	A non-dimensional coefficient equal to the ratio of the jet reaction to the product of the wing area and the dynamic pressure of the undisturbed stream.
4414	Quantity Coefficient (Flow Coefficient)	A non-dimensional flow rate coefficient. It is defined as the ratio of the mass-flow rate to the product of a

No.	Term	Definition
		Specified surface area and the speed and density of the undisturbed flow, The surface area used for a wing may be only that portion of the area corresponding to the span wise extent of the boundary layer control.
4415	Supercircutation	The additional circulation round an aerofoil which occurs when air or gas is blown along the upper surface at a rate greater than that required to suppress boundary-layer separation.
4416	Boundary-Layer Thickness	The distance from a surface at which the conditions approximate closely to those in the potential flow just outside the boundary layer, as expressed either by the velocity in the case of hydrodynamic boundary layer, or by the temperature in the case of thermal boundary layer.
4417	Displacement Thickness	A hypothetical boundary layer thickness which is a measure of the mass flow defect in a boundary layer.
4418	Energy Thickness	A hypothetical boundary layer thickness which is a measure of the energy flow defect in a boundary layer.
4419	Momentum Thickness	A hypothetical boundary layer thickness which is a measure of the momentum flow defect in a boundary layer.
4420	Choking	A condition which arises in the flow through a duct as the mean speed approaches the sonic value in which, at a given up-stream pressure, a decrease in the down-stream pressure produces no increase in the rate of mass flow.
4421	Circulation	The integral of the component of the fluid velocity along any closed path with respect to the distance round the path.
4422	Doublet	An elementary type of flow represented mathematically by the limiting form taken by a source and sink of equal strength, when their respective strengths increase indefinitely as their distance apart along the line joining them (the axis of

No.	Term	Definition
		the doublet) approaches zero in such a manner that the product strength times distance (the strength of the doublet) remains finite.
4423	Eddy	An element of fluid having intense vorticity.
4424	Eddy Diffusivity Coefficients	Coefficients of eddy flux (for example, of momentum, heat, water vapour, etc.) in turbulent flow, defined as the ratio of the rate of flux of a quantity to the mean gradient of the quantity in the direction of the flux.
4425	Filament Line (Streak Line)	The line adjoining the positions at any instant of all particles that have passed through a given point in the fluid.
	Flows	
4426	Adiabatic Flow	Flow of a fluid in which there is no addition or extraction of heat.
4427	Choked Flow	<i>See</i> Choking 4420 .
4428	Compressible Flow	Flow at speeds such that the density changes in the fluid can no longer be neglected (<i>see</i> 4431).
4429	Continuum Flow	Flow of a fluid under conditions for which the density is sufficiently high that the molecular structure of the fluid can be ignored and the fluid can be considered as physically continuous.
4430	Free Molecule Flow	Flow where the mean free path of the molecules near the body is appreciably larger than a typical linear dimension of the body.
4431	Incompressible Flow	Flow in which density changes in the fluid can be neglected (<i>see</i> 4428).
4432	Irrotational Flow	Flow in a region in which there is no vorticity.
4433	Isentropic Flow	Flow in which the entropy of each element of fluid remains constant.

No.	Term	Definition
4434	Laminar Flow	Flow in which there is no mixing between adjacent layers (except on a molecular scale).
4435	Couette Flow	Laminar flow of a fluid between two surfaces in relative motion parallel to one another.
4436	Poiseuille Flow	Laminar flow, in a pipe of circular cross section, of a gas or of a liquid which entirely fills the pipe.
4437	Mixed Flow (Transonic Flow)	Flow in which there are regions of both subsonic and supersonic speed.
4438	Potential Flow (Irrotational Flow)	Flow of an ideal, inviscid fluid in which the vorticity is zero everywhere.
4439	Rotational Flow	Flow in a region in which there is vorticity.
4440	Slip Flow	Flow where the mean free path of the molecules is a significant fraction of a typical linear dimension of the body and fluid adjacent to a solid surface is not necessarily at rest relative to the surface.
4441	Subsonic Flow	Flow in which the speed is everywhere subsonic.
4442	Supersonic Flow	Flow in which the speed is everywhere supersonic.
4443	Transition Flow (Knudsen Flow)	The flow of gases under conditions intermediate between continuum flow and molecular flow.
4444	Turbulent Flow	Flow in which irregular fluctuations with time are superposed on a mean flow.
4445	Free Stream Velocity	The velocity of the undisturbed fluid relative to a body immersed in it.
4446	Froude Number	<p>The velocity divided by the square root of the product of a typical length and the acceleration due to gravity. It expresses the square root of the ratio of the inertial to the gravitational forces.</p> <p>NOTE — Alternatively, taken as the square of the above.</p>
4447	Grashof Number	The product of the cube of a typical length, the acceleration due to gravity and a representative temperature difference divided by the product of the

No.	Term	Definition
		square of the kinematic viscosity and the absolute temperature. In free convection for gases, it expresses the ratio of the product of the inertial and buoyancy forces to the square of the viscous forces.
4448	Heat Transfer Coefficient	A non-dimensional quantity determining the rate of transfer of heat between a surface and a fluid flowing past it for given aerodynamic and surface conditions.
4449	Hilsch Tube (Hilsch-Rankine Tube Vortex Tube)	An apparatus in which total temperature differences are produced by exploiting the properties of vortex flow (<i>see</i> 4521).
4450	Kinematic Viscosity	The coefficient of viscosity of a fluid divided by its density.
4451	Knudsen Number	The ratio of the mean free path of the molecules to a typical linear dimension in the flow field.
4452	Lewis Number	The product of the density, the material diffusivity and specific heat at constant pressure of a fluid divided by its thermal conductivity. It expresses the ratio of the diffusivity of matter to that of heat through a fluid.
4453	Lifting Line	A simple mathematical model of the flow around a wing (or aerofoil) in which the bound vorticity of the wing is assumed concentrated on to a single line. It is used for the calculation of the induced velocities away from the wing.
4454	Mach Angle	The angle between the direction of flow at any point and the Mach line; its cosecant is equal to the Mach number at the point.
4455	Mach Line	A line on a Mach surface such that the tangent at any point is co-planar with the direction of flow and with the normal to the Mach surface at their point.
	Mach Numbers	
4456	Local Mach Number	The ratio of the fluid speed to the local speed of sound. It expresses the square root of the ratio of the inertial to the elastic forces in a fluid.

No.	Term	Definition
4457	First Critical Mach Number	The free stream Mach number at which the peak velocity on the surface of a body first becomes equal to the local speed of sound.
4458	Mach Surface (Characteristic Surface)	A surface indicating the wave front of an infinitesimal disturbance in a supersonic flow.
4459	Mach Cone	A Mach surface in a uniform supersonic flow.
4460	Magnus Effect	The additional aerodynamic forces, produced on a rotating body (especially a body symmetrical with respect to the relative stream) moving through a fluid, due to the component of velocity normal to the axis of rotation. The classical case is the lift on an infinite circular cylinder rotating about its axis in a stream normal to the axis.
4461	Nusselt Number	The product of the rate of heat transfer per unit area and typical length divided by the product of the thermal conductivity and a representative temperature difference. It is the ratio of convective to conductive heat transfer.
4462	Particle Path	The track of any infinitesimal element or particle of a fluid.
4463	Peclet Number	The product of the Prandtl number and the Reynolds number.
4464	Prandtl-Meyer Expansion	A homentropic, two-dimensional supersonic flow in which an expansion wave is produced at the junction of two plane boundaries.
4465	Prandtl Number	The product of the viscosity and specific heat at constant pressure of a fluid divided by its thermal conductivity. It expresses the ratio of the transport of momentum to that of heat through a fluid.
	Pressures	
4466	Dynamic Pressure	The difference between the total pressure and the static pressure. It is equal to half the product of the fluid density and the square of the speed.

No.	Term	Definition
4467	Impact Pressure (Indicated Dynamic Pressure)	The difference between the pitot pressure and the static pressure.
4468	Kinetic Pressure	The kinetic energy per unit volume of a fluid. It is equal to half the product of the fluid density and the square of the speed. In incompressible flow, it equals the dynamic pressure and was so called formerly.
4469	Momentum Pressure	The momentum flux per unit area across a surface normal to the local flow. It is equal to the product of the fluid density and the square of the speed.
4470	Pitot Pressure	The pressure measured by a pitot tube correctly aligned with the local direction of flow. At a point where the flow is subsonic, it is equal to the total pressure; at a point where the flow is supersonic, it is equal to the total pressure behind a normal shock wave (<i>see</i> 4488).
4471	Reaction Pressure	The sum of the static pressure and the momentum pressure.
4472	Stagnation Pressure	The pressure at a stagnation point on a body where fluid is brought isentropically to rest.
4473	Static Pressure	The mean of the normal components of stress on three mutually perpendicular elements of surface at rest relative to a fluid. It is the pressure which would be measured by an infinitesimally small instrument at rest relative to the fluid.
4474	Total Pressure	The pressure which would arise if a fluid were brought to rest isentropically.
4475	Rayleigh Number	The product of the Grashof number and the Prandtl number.
4476	Reynolds Number	The product of a typical Length and the fluid speed divided by the kinematic viscosity of a fluid. It expresses the ratio of the inertial forces to the viscous forces.

No.	Term	Definition
4477	Schlieren System	A means of visualizing or photographing an airflow pattern by use of the effect of the density variations on the refractive index.
4478	Schmidt Number	The viscosity of a fluid divided by the product of the density and the material diffusivity. It expresses the ratio of the transport of momentum to that of matter through a fluid.
4479	Separation (Breakway)	Detachment of the flow from a solid surface with which it has been in contact.
4480	Boundary Layer Separation	The separation of a flow having a boundary layer, either laminar or turbulent.
4481	Dead-Air Region	A separated region in which the fluid velocity is low.
4482	Laminar Separation	Boundary layer separation when the boundary layer is still laminar.
4483	Re-attachment	Re-adherence of the flow to a solid surface after separation.
4484	Separated Region	A region over which the flow is separated from the surface.
4485	Separation Bubble	The region bounded by a re-attaching flow and the solid surface between the positions of separation and re-attachment.
4486	Turbulent Separation	Boundary-layer separation after transition.
4487	Shock-Stall	A stall brought on by separation of flow behind a shock wave.
4488	Shock Wave	A narrow region, crossing the streamlines, through which there occur abrupt increases in pressure, density and temperature, and an abrupt decrease in velocity, accompanied by an increase in entropy. The normal component of velocity relative to the shock wave is supersonic upstream and subsonic downstream. It is called attached or detached according to whether it does or does not appear to be in contact with the body originating it. It is described as normal

No.	Term	Definition
		or oblique according to whether it is perpendicular or not to the direction of flow in a supersonic flow field.
4489	Sink	In the mathematical representation of fluid flow, a point at which the fluid is absorbed.
4490	Sonic Bang (Sonic Boom)	The noise heard when shock waves from an aircraft flying at or above the speed of sound reach the observer.
4491	Source	In the mathematical representation of fluid flow, a point from which the fluid emanates.
	Speeds	
4492	Sonic Speed	The local speed of sound.
4493	Subsonic Speed	A speed below sonic speed.
4494	Supersonic Speed	A speed above sonic speed.
4495	Hypersonic Speed	A very high speed usually more than five times the sonic speed.
4496	Transonic Speed Range	The range of undisturbed stream speeds near the local speed of sound when mixed flow regions occur in the neighbourhood of the body.
4497	Stagnation Point	The point, at or near the nose of a body in motion in a fluid where the flow divides and where, in a viscous fluid, pressure is at a maximum, and in an inviscid one the fluid is at rest.
4498	Stanton Number	The ratio of the Nusselt number to the Peclet number. In forced convection, it expresses the ratio of the heat abstracted from a fluid to the heat passing within it.
4499	Streamline	A line such that, at any instant, the local direction of flow at any point on it is in the direction of the tangent.
4500	Streamtube	A-surface formed by streamlines whose intersections on a transverse plane form a closed curve.

No.	Term	Definition
4501	Super aerodynamics	The study of fluid motion in conditions (for example, at high altitude) in which the fluid pressure is so low that the conditions of continuum flow no longer apply.
Temperatures		
4502	Static Temperature	The actual temperature at a point in a fluid. Ideally, it is the temperature measured by an infinitesimally small instrument, which is at rest relative to the fluid.
4503	Total Temperature (Stagnation Temperature)	The temperature which would arise if the fluid were brought to rest adiabatically.
4504	Tip Loss	Loss of lift at the tip of an aerofoil associated with the formation of tip vortices.
4505	Transition	Of a boundary layer. The change from laminar to turbulent flow.
Vortex		
4506	Vortex	A region of fluid in circulatory motion, having a core of intense vorticity, the strength of the vortex being given by its circulation.
4507	Bound Vortex	A virtual vortex formed by the vortex sheet which surrounds the surface of a body.
4508	Cast-Off Vortex (Starting Vortex)	A vortex left behind when a body is set in motion.
4509	Free Vortex	A vortex free to travel downstream with the fluid, such as a tip vortex.
4510	Tip Vortex	A free vortex arising at the tip of an aerofoil owing to the flow of air around the tip from the high-pressure region to the low-pressure region.
4511	Horseshoe Vortex	A vortex consisting of a vortex transverse to the air-stream with a trailing vortex springing from each of its ends. The transverse vortex may be either a bound vortex to replace an aerofoil or a free vortex to represent vorticity in the wake. A system of

No.	Term	Definition
		horseshoe vortices is used for purposes of simplification in aerofoil theory.
4512	Line Vortex	A vortex in which the vorticity is concentrated in a line.
4513	Point Vortex	A cross section of a line vortex in two dimensional flow.
4514	Trailing Vortex	A vortex extending downstream from the surface of a body.
4515	Vortex Trail (Tip Trail)	A trailing vortex made visible by the condensation of water vapour in the atmosphere in regions of reduced temperature, for example downstream of the tip of a wing or propeller.
4516	Vortex Line	A line such that its direction is everywhere that of the vorticity.
4517	Vortex Ring	A vortex having a toroidal core.
4518	Vortex Sheet	A surface across which there is a discontinuity in the velocity component tangential to the surface.
4519	Vortex Layer	A diffuse vortex sheet. A thin layer of fluid between two streams in which there is a large gradient in tangential velocity.
4520	Vortex Street	A regular arrangement of line vortices in two approximately parallel rows, which is sometimes formed behind two-dimensional bodies.
4521	Vortex-Tube	A surface formed by vortex lines whose inter-sections on a transverse plane form a closed curve (<i>see 4449</i>).
4522	Vortex Filament	An infinitesimal vortex-tube.
4523	Vortex Generator	A device, often a small vane attached to a surface, to produce one or more discrete vortices which trail downstream adjacent to the surface, promote mixing in the boundary layer and delay boundary layer separation.

No.	Term	Definition
4524	Vorticity	Generally, rotational motion in a fluid, defined, at any point in the fluid, as twice the mean angular velocity of a small element of fluid surrounding the point. The component vorticity in a given direction at a point in a fluid is equal to the circulation round an elementary surface normal to the direction divided by the area of the surface.
4525	Wake	The region of fluid behind a body in which the total pressure has been changed by the presence of the body.
SECTION 46 MODEL TESTING		
4601	Blockage	Of a subsonic wind tunnel. The effect of the presence of a model on the equivalent free stream speed in the working section.
4602	Solid Blockage	The contribution to blockage due to the obstruction of the stream by the model itself.
4603	Wake Blockage	The contribution to blockage due to the displacement of the stream by the wake from the model.
4604	Collector	A bell-mouth downstream of an open working section.
4605	Diffuser	A device for transforming kinetic energy of a fluid into pressure energy; in subsonic flow, a duct which increases gradually in section along the direction of flow (<i>see 4609</i>).
4606	Second Throat	A convergent-divergent diffuser placed down-stream of the working section of a supersonic wind tunnel.
4607	Diffuser Cone-Angle	The angle between the axis and the generator of a right circular cone for which the rate of change of cross-sectional area with distance along the axis is the same as that of the diffuser.
4608	Dynamic Model (Inertial Model)	A model for which the mass distribution and linear dimensions have been so scaled that certain features of the motion of both model and full-scale aircraft are

No.	Term	Definition
		the same, apart from the effect of scale (Reynolds number) on the aerodynamics.
4609	Effuser	A device for transforming the pressure energy of a fluid into kinetic energy (<i>see</i> 4605).
4610	Contraction	An effuser, or part of an effuser, in which the cross-sectional area of the duct is progressively decreased with the objects of accelerating the fluid and obtaining a more nearly uniform flow.
4611	Contraction Ratio	The ratio of the cross-sectional area at the beginning of the contraction to that at the working section of a wind tunnel.
4612	Nozzle	<p>a) An effuser, or part of an effuser, in a supersonic wind tunnel in which the fluid is accelerated from subsonic to supersonic speed by means of a convergent divergent duct and a region of uniform flow is achieved. It is sometimes called a supersonic effuse; and</p> <p>b) The contraction of a subsonic wind tunnel having an open working section.</p>
4613	Elastic Model	A model in which the distribution of stiffness as well as the linear dimensions are so represented as to make the aeroelastic behaviour of the model correspond to that of the full-scale aircraft.
4614	Fan Straighteners	Radial vanes installed near the fan in a wind tunnel to counteract the rotation of the stream produced by it.
4615	Flexible Wall	A solid wind tunnel boundary whose shape can be adjusted in order to vary the Mach number, the pressure gradient in the working section or the extent of the tunnel constraint.
4616	Freen	A trade name for a range of compounds. Some are used in the gaseous form in supersonic research or other tests. Shock wave patterns in Freen are similar to those in air at higher Mach numbers.
4617	Guide Vanes (Cascade)	A cascade of fixed vanes which guide the fluid stream round the bends in a flow duct.

No.	Term	Definition
4618	Gust Tunnel	A tunnel in which the air flow can be modified to simulate a gust or in which the model can be moved rapidly (for example, on a rocket track) across a moving airstream for the same purpose.
4619	Honeycomb	A grid of intersecting surfaces in a wind tunnel to reduce large-scale disturbances and to straighten the flow.
4620	Liner	An interchangeable wall inserted upstream of the working section of a supersonic wind tunnel and shaped to form one side of a two-dimensional nozzle.
4621	Rocket Sled	A sled that runs on a rail or rails (rocket track) and is accelerated to high velocities by a rocket engine.
4622	Screen	A gauze screen placed across the stream in a wind tunnel for reducing spatial disturbances and turbulence levels.
4623	Shock Tube	A long tube in which a shock wave is created usually by bursting a diaphragm initially isolating the high pressure region from the low pressure one. The shock wave travels along the tube and increases the pressure and temperature of the gas into which it travels.
4624	Shock Tunnel	Shock tunnel is a modified version of the shock tube in which the desired Mach number is obtained with the help of a nozzle.
4625	Gun Tube	A form of shock tube in which the shock wave is generated by a moving piston.
4626	Sting	An arm, projecting upstream in a wind tunnel, to the forward end of which a model can be attached.
	Tanks	
4627	Controlled-Launching Tank	A tank into which models are launched under controlled conditions for observation of their behavior when landing on water.
4628	Ditching Tank (Free-Launching Tank)	A large tank into which models are freely launched for observation of their behaviour when landing on water.

No.	Term	Definition
4629	Towing Tank	A long channel provided with a travelling carriage to which models are attached for testing in or on water.
4630	Throat	A section of minimum area in a duct.
4631	Water Channel	An open channel for investigating the flow past a stationary body in a stream with a free surface.
4632	Water Tunnel	An apparatus for producing a controlled stream of water or other liquid for fluid dynamic experiments.
4633	Whirling Arm	An apparatus for making experiments by carrying models or instruments at the extremity of an arm rotating in a horizontal plane.
4634	Wind Tunnel	An apparatus for producing a controlled stream of air or other gas for fluid dynamic experiments.
4635	Blow-Down Wind Tunnel	A wind tunnel in which the driving power is derived from gas stored in pressurized vessels.
4636	Compressed-Air Wind Tunnel	A wind tunnel in which compressed air is used as the working fluid in order to obtain high values of the Reynolds numbers.
4637	Continuous Wind Tunnel	A wind tunnel that is designed to run continuously, the stream usually being driven by a fan or compressor.
4638	Direct-Discharge Wind Tunnel	A wind tunnel driven by connecting the up-stream end to a compressed air storage vessel and/or the downstream end to an evacuated tank.
4639	Free-Flight Wind Tunnel	A wind tunnel in which the model can be observed in free flight.
4640	Heated-Air Wind Tunnel	A wind tunnel in which the air is heated, for example, to avoid liquefaction at high values of the Mach number.
4641	Induced-Flow Wind Tunnel	A wind tunnel in which compressed air or other gas is used to induce the flow through the working section.

No.	Term	Definition
4642	Intermittent Wind Tunnel	A wind tunnel that can run for a limited period only, the source of power being pressurized and/or evacuated vessels which require pressurizing or evacuating between runs.
4643	Low-Density Wind Tunnel	A wind tunnel capable of producing slip flow or free molecule flow, characterized by a low stagnation pressure small compared with that of the atmosphere.
4644	Non-Return-Flow Wind Tunnel (Straight-Through Wind Tunnel)	A wind tunnel not provided with a duct between the downstream end of the diffuser and the upstream end of the contraction.
4645	Open-Jet Wind Tunnel	A wind tunnel with an open working section.
4646	Return-Flow Wind Tunnel	A wind tunnel provided with a duct between the downstream end of the diffuser and the upstream end of the contraction.
4647	Shock Tunnel	A wind tunnel in which the high Mach numbers and high stagnation enthalpy associated with hypersonic flight are simulated by expanding the flow generated by a shock tube through a nozzle.
4648	Spinning Tunnel (Free-Spinning Wind Tunnel)	A wind tunnel with a vertical air stream in the working section, for testing the spinning characteristics of unconstrained models.
4649	Suck-Down Wind Tunnel (Vacuum Tunnel)	A wind tunnel in which the driving power is derived from evacuated vessels.
4650	Wind Tunnel Balance	An apparatus for measuring aerodynamic forces and moments acting on a model supported in the working section of a wind tunnel.
4651	Rolling Balance	A wind tunnel balance for measuring aerodynamic forces and moments while the model is rotating about a longitudinal axis.
4652	Six-Component Balance	A wind tunnel balance for measuring a complete system of forces and moments about three axes.

No.	Term	Definition
4653	Three-Component Balance	A wind tunnel balance for measuring three components of forces and moments, usually lift, drag and pitching moment.
4654	Working Section	That part of a wind or water tunnel where experiments are made.
4655	Closed Working Section	A working section that is bounded by solid walls.
4656	Open Working Section	A working section that is not bounded by walls.
4657	Slotted (Perforated) Walls	Tunnel walls with slots (perforations) to reduce tunnel constraint, particularly to enable wind tunnels to be used at transonic speeds.
4658	Ventilated Working Section	A working section whose boundaries are partly open (slotted longitudinally, perforated or porous), especially for experiments at transonic speeds.

ANNEX A
(Foreword)

COMMITTEE COMPOSITION

AIR AND SPACE VEHICLES SECTIONAL COMMITTEE SECTIONAL COMMITTEE, TED 14

<i>Organization</i>	<i>Representative(s)</i>
IN Personal Capacity	SHRI DILIP B BHATT (<i>Chairman</i>)
Adani Aerospace and Defence Limited, Bengaluru	SHRI SAMPATHKUMARAN S T
Aeronautical Development Agency, Bengaluru	SHRI D K P SINHA SHRI RAMMOHAN V KAKI (<i>Alternate</i>)
Aeronautical Development Establishment, Bengaluru	SHRI A VAMSIKRISHNA SHRI RANJITH T (<i>Alternate</i>)
Air India, New Delhi	SHRI MATHEW PANICKER
Airports Authority of India, New Delhi	SHRI D DILIP KUMAR
Bharat Dynamics Limited, Hyderabad	SHRI J K MISHRA SHRI KV SUBBA REDDY (<i>Alternate</i>)
CSIR - National Aerospace Laboratories, Bengaluru	SHRI VEERA SESA KUMAR SHRI S RAVISHANKAR (<i>Alternate</i>) DR. SAPTHAGIRI G (<i>Alternate</i>)
Centre for Military Air worthiness and Certification, Bengaluru	SHRI P JAYAPAL SHRI R KAMALAKANNAN (<i>Alternate</i>)
Defence Research and Development Organization, Research Centre Imarat, Hyderabad	DR. S KARUNANIDHI SHRI SSSBS SUBBA RAO (<i>Alternate</i>)
Department of Defence Production, Ministry of Defence, New Delhi	SHRI ARINDAM CHAUDHARY
Directorate General of Aeronautical Quality Assurance, Ministry of Defence, New Delhi	SHRI SANJAY KUMAR SHARMA SHRI MUKESH CHAND MEENA (<i>Alternate</i>)
Directorate General of Civil Aviation, New Delhi	SHRI BHARAT LAL SHRI VEERENDRA KUMAR KABIR (<i>Alternate</i>) SHRI ASEEM KUMAR
Directorate of Naval Air Material, Ministry of Defence	SHRI D D DARKE SHRI R RAJESH (<i>Alternate</i>)
GAIL (India) Limited, New Delhi	SHRI KAUSHIK DAS
Gas Turbine Research Establishment, Bengaluru	SHRI G DEVEANANDA SHRI D NAGARAJU (<i>Alternate</i>)

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<i>Organization</i>	<i>Representative(s)</i>
Godrej Aerospace, Mumbai	SHRI AMOL BANSI THORAT
HQ Maintenance Command, Indian Air Force	SHRI F J D'SOUJA SHRI V. K. GOEL (<i>Alternate</i>)
Hindustan Aeronautics Limited, Bengaluru	SHRI PRATAP PANDA SHRI SUSHIL KUMAR (<i>Alternate</i>)
Indian Institute of Science, Bengaluru	DR. SATISH L. DR. L. UMANAND (<i>Alternate</i>) DR. SUBBA REDDY B (<i>Alternate</i>)
Indian Institute of Technology Madras, Chennai	PROF. HARISHANKAR RAMCHANDRAN
Indian National Space Promotion and Authorisation Centre (IN-SPACe), Ahmedabad	SHRI PARAGJYOTI GARG
Indian Space Research Organization - U R Rao Satellite Centre, Bengaluru	SHRI RAGHAVENDRA KULKARNI SHRI RAYAN KUTTY P P (<i>Alternate</i>)
Indian Space Research Organization - Vikram Sarabhai Space Centre, Thiruvananthapuram	SHRI P. RAMKUMAR SHRI JAYAKUMAR M SHRI GOVIND (<i>Alternate</i>)
Indian Space Research Organization, Bengaluru	DR. A K ANIL KUMAR SHRI MANISH SAXENA (<i>Alternate</i>)
Larsen and Toubro Limited, Mumbai	SHRI LAXMESH B.H. SHRI JAMBUNATHAN G (<i>Alternate</i>)
Society of Indian Aerospace Technologies and Industries, Bengaluru	SHRI FRANCIS XAVIER
Sundram Fasteners Limited, Chennai	SHRI ATUL KUMAR AGRAWAL
In personal capacity	SHRI MANOHAR SIDANA
In personal capacity	SHRI S C SHRIMALI
BIS Directorate General	SHRI P.V. SRIKANTH, SCIENTIST 'D' & HEAD (TED) [REPRESENTING DIRECTOR GENERAL (EX-OFFICIO)]

MEMBER SECRETARY
MR. SHIVAM AGGARWAL
SCIENTIST C / DEPUTY DIRECTOR
(TRANSPORT ENGINEERING DEPARTMENT)