INTER PLANT STANDARD IN STEEL INDUSTRY		
IPSS	**DEFINITION OF TERMS RELATING TO MAINTENANCE & EQUIPMENT PERFORMANCE**	**IPSS : 3-02-006-18**
	Corresponding IS does not exist	Formerly: IPSS:3-02-006-07

0. FOREWORD

0.1 Interplant standardization in steel industry was initiated under the aegis of the Indian Standards Institution (ISI) and the Steel Authority of India Limited (SAIL). This IPSS was prepared by the standard committee on Operation and Maintenance, IPSS 3:2 and firstly published in 1995. Lastly, this has been revised by the standard committee in July 2018 with the active participation of the representatives from major Indian steel plants and leading consultants.

0.2 With the growing emphasis on adoption of quality system as per ISO 9000 series of standards, IPSS 3:2 has felt the necessity for having terms relating to maintenance & equipment performance properly defined to avoid any ambiguity of meaning and hence this standard.

1. SCOPE

1.1 This standard covers definitions of terms relating to maintenance & equipment performance.

2. DEFINITIONS

2.1 **ASSEMBLY** - An assembly is an orderly combination of individual parts/sub-assemblies, which can perform desired function.

2.2 **ASSET** - An asset is Capital Item, which can independently by itself produce goods or render services. An asset is not a spare item and can render its service anywhere without reference to particular equipment.

2.3 **ATTACHMENT & ACCESSORIES** - An attachment or an accessory does not necessarily form a spare part of equipment but enhances the performances of the equipment when these are added on.

2.4 **AVAILABLE HOURS** - Installed calendar hours minus planned repair hours.

2.5 **BREAKDOWN** - Any unplanned stoppage of equipment/mechanism due to damage to the equipment or system resulting in its inability to perform its function.

2.6 **BREAKDOWN MAINTENANCE** - The maintenance carried out on an equipment when it has already failed to perform its intended or desired function.

2.7 **COMPLETE UNIT** - A complete unit is an equipment which can produce goods or render service but can be used a spare part of larger installations (pumps, compressors, motors, generators, cylinders, transformers etc.)

2.8 **CONSUMABLE** - A consumable is an item which is required for the production process but does not form part of the end product.

2.9 **CONDITION BASED MAINTENANCE SYSTEM** - In this technique, the maintenance is carried out depending on actual condition of equipment to avoid failures. The condition of equipment is assessed and predicted after checking by the application of any one or combination of following methods:

a) Use of basic human senses

b) Use of conventional primary instrument

c) Application of sophisticated tools

d) Through product quality

2.10 **CAPITAL REPAIR** - These are normally carried out once in a year or at higher interval to bring back the equipment / unit to normal. The repair cost, and cost of spares are capitalized.

2.11 **CHECKING** - Checking is a short time activity to find out and assess the condition of equipment either with the help of human senses or aided with small tools and is carried out on equipment either in running condition or idle condition.

2.12 **DESIGN OUT MAINTENANCE** - When the failure of the same nature is taking place again and again and no method of maintenance is able to prevent failures, the equipment must be redesigned and it is known as design out/re-design maintenance.

2.13 **DELAY** - Any unplanned stoppage of equipments or system affecting production is considered as delay.

2.14 **DESIGN DEFICIENCY** - If the equipments/sub-assembly fails quite frequently and is unable to perform under normal working condition, it is considered to have design deficiency.

The lack of accessibility of the part of assembly for repairs, use of sub-standard material, low factor of safety in original design, ignorance of design aspects and regular failure are some of the reasons for design deficiency.

2.15 **FAILURE** - Inability of an item or component to meet specified/intended function, when the performance of unit goes below the expected norms.

2.16 **INTERRUPTION** - Interruption is a forced stoppage / restricted operation of otherwise smoothly running system/production unit and is normally of short duration.

2.17 **INSPECTION** - Inspection is an activity where the machine part or the equipment is examined closely and assessed for defects or deficiencies. It can be short term or long term. Checking falls under short term inspection. Long term inspection involves opening up the equipment and measuring various parameters.

2.18 **INSTALLED CALENDAR HOUR (ICH)** - The no. of units multiplied by 24 hours in a day are installed calendar hour for the day and similarly for month & year.

2.19 **JIGS & FIXTURES** - A jigs is an enabling attachment for a machining operation which locates the points on work piece correctly and guides the tool to perform the machining operation. It restricts the degrees of freedom of an operating tool and work piece.

A fixture is an enabling attachment which locates the reference point on a work piece and limits its degree of freedom.

2.20 **LIFE CYCLE TIME** – This is the total period from commissioning of an equipment till it has given its full functional life.

2.21 **MAINTENANCE** – Any action taken to keep/restore equipment or system in a condition to perform its intended or desired function is termed as Maintenance.

2.22 **MAJOR REPAIR** – This is defined where the duration exceeds 3 shifts but less than 6 shifts and is not a capital repair.

2.23 **MAINTENANCE DELAY** – Any unplanned stoppage of equipments or system affecting production due to the failure of the equipment, system is maintenance delay. If it is a mechanical failure it is treated as mechanical delay and if failure is electrical it is considered as electrical delay.

2.24 **OPERATION DELAY** – Operation delay is the delay due to Operational agency affecting production and includes delays due to non-availability of input materials, stoppages of upstream facilities.

2.25 **PLANNED MAINTENANCE/ SCHEDULED MAINTENANCE** – The maintenance activities carried out with fore thought and control where all aspects of jobs are considered so that maintenance information, planning, special tools & tackles and safety of the job are taken care of, feedback of the action taken and history records forms an integral and essential part of planned maintenance.

2.26 **RUNNING MAINTENANCE** – It is a form of preventive maintenance carried out while the plant or equipment is continuing to perform its function. It involves activities such as inspection, tightening the bolts, cleaning, adjusting and lubrication. This can also be termed as “servicing”.

2.27 **REVAMPING** - Revamping is an activity of capital repair nature wherein complete assemblies & sub-assemblies of an equipment are not only changed but also new accessories and attachments are added to improve performance of the equipment.

2.28 **REBUILDING** - Rebuilding as applied to steel industry generally refers to Rebuilding of Coke Oven Batteries. This involves complete dismantling & demolishing of the Oven structures above foundation and rebuilding of entire new battery with its civil, structural and refractory works.

2.29 **RELINING** - It applies to relining of the Blast Furnaces, Hot Metal Mixer, Open Hearth & Twin Hearth Furnaces, LD Converters, Soaking Pits and Ladles. Relining involves complete dismantling of old worn out refractory lining and putting new lining in its place.

2.30 **RELIABILITY CENTRAL MAINTENANCE (RCM)** - RCM is an integrated maintenance strategy which determines maintenance requirement of each item of equipments in its operating context. It recognizes that all the possible approach to maintenance have part to play in modern maintenance system. By taking consequences of failure into consideration it helps in selecting the most appropriate maintenance strategy for any given situation.

2.31 **SUB-ASSEMBLY** - A Sub-assembly is an orderly combination of individual parts which can be used as replacement as a unit.

2.32 **SHUTDOWN MAINTENANCE** - It is often both preventive and corrective work which is normally implemented when plant or equipment is taken out of service specifically for maintenance.

2.33 **SPARES** - A spare of an equipment is a single part or sub-assembly subjected to wear and can be replaced by another identical single part or sub-assembly which restores the equipment's normal function. A spare is a revenue item. A spare by itself can not serve any useful function.

2.34 **TIME BASED MAINTENANCE** - Replacement or repair at a fixed time interval before failure is known is time based maintenance.

2.35 **TOTAL DELAY** - Total delay is sum of all delays due to various agencies like operation, maintenance and services.

MAINTENANCE INDICES

2.38A **GROSS EQUIPMENT AVAILABILITY**

$$\frac{\text{Installed Calendar Hours - Planned Repair Hours}}{\text{Installed Calendar Hours}} \times 100$$

2.38B **NET EQUIPMENT AVAILABILITY**

$$\frac{\text{ICH - (Planned + Unplanned Repairs in Hours)}}{\text{Installed Calendar Hours (ICH)}} \times 100$$

2.39 **EQUIPMENT UTILIZATION**

$$\frac{\text{ICH - (Planned Repairs + Total Delays)}}{\text{Installed Calendar Hours}} \times 100$$

For total delay, refer clause no. 2.35

2.40 **INSPECTION INDEX**

$$\frac{\text{No. of Inspections carried out}}{\text{No. of inspections planned}} \times 100$$

2.41 **JOB FULFILLMENT**

$$\frac{\text{No. of jobs fulfilled}}{\text{No. of jobs planned}} \times 100$$

2.42 **CAPITAL REPAIR FULFILLMENT EFFECTIVENESS**

$$\frac{\text{No. of jobs actually done}}{\text{No. of jobs planned}} \times \frac{\text{Job days planned}}{\text{Job days actual}}$$

2.43 **EMERGENCY WORK RATIO**

$$\frac{\text{Man hours spent on unplanned maintenance}}{\text{Man hours spent on total maintenance jobs}}$$

2.44 **EQUIPMENT FAILURE FREQUENCY**

$$\frac{\text{No. of occurrences of maintenance delays}}{\text{Installed Calendar Hours}} \times 100$$

2.45 **EQUIPMENT FAILURE INTENSITY**

Maintenance delays in hours

_____ x 100

Installed Calendar Hours

2.46 **MEAN TIME BETWEEN FAILURES (MTBF)** - It is the mean time between the occurrence of consecutive faults or failures and is a measure of functional reliability.

2.47 **MEAN TIME TO FAILURE (MTTF)** - It is the average time from conclusion of work to rectify a fault until the next fault occurs. It is also a measure of functional reliability.

2.48 **MEAN TIME TO REPAIR (MTTR)** - It is the mean time to repair and is a measure of equipment maintainability.

2.49 **MEANTIMEBETWEEN SHUTDOWN (MTBS)** – It is a duration between one planned shutdown to another planned shutdown. It is a measure of RCM (Reliability Central Maintenance) and helps in improving plant utilization.

2.50 **MAINTENANCE COST**

Elements:

1. Spares consumption (purchase + in-house manufactured)
2. Labour Cost (Department + Contractual)
3. Cost of consumables & stores
4. Cost of services

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