

Statutory Codes of Our Country & Their NDT Perspectives

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ABSTRACT

OUR Country has basically three STATUTORY **CODES** in form of ACTs promulgated by the Govt. of India. (i) **The Govt. Factory Act 1948** ;(ii) **The Indian Boilers Act - 1923 &** (iii) **The Indian Explosives Act - 1884**. The 4th Statutory Body is **Atomic Energy Act -AERB** [Atomic Energy Regulatory Board]

Factory Act 1948 is empowered with the task of regulating Industries / Factories in the state with the primary aim of welfare of the workers, in respect of Occupational Safety, Health hazards, remuneration and regulatory compliances. **Indian Boilers Act -1923 &** its counterpart **Indian Boiler Regulations [IBR] 1950** is loaded with the task of Boiler Units construction, operation and overall safety in companies using Boilers.

The Indian Explosives act-1884 in conjunction with Explosives Rules 2008 looks after construction, use of vessels , Closed - containers handling of explosives materials on Land , Sea or in Space such as aircrafts or Satellites. **AERB** [Atomic Energy Regulatory Board] Guides, Controls & Regulates safety aspects of Power generation through Atomic Power Plants/ Installations and Classified Projects.

These Codes cover different areas of working to take care of quality aspects and avoid mishaps/ accidents in Plants/ Factories ,be it Chemical, Petro-chemical, Manufacturing or pharmaceutical companies or House hold Appliances. The Rules & Regulations mentioned therein are not merely the guide lines like those of fabrication codes i.e. ASME Section VIII Divn I , IS 2825-1969 or BS 5500 but are the Legal requirements and are en forcible by the Acts to the user.The Rules & Regulations are the legal binding by the user ,the manufacturer, the inspecting authorities and all other parties associated with the overall activities .

These codes mention about the use of various NDT techniques in ensuring and maintaining required quality standard of the product, machines & equipments . This paper presents a comparative study of the use of NDT Methods and their respective weight ages. The actual relevance and practical importance of these NDT techniques are outlined in this paper .

The Periodicity of Inspection, Testing and Certification of Equipments/ Products, Machines & Utilities is defined differently under these Codes . However these are promulgated as mandatory requirements in very clear terms and bypassing is not allowed. The Time- frame & Inspection -cycles are different under these Statutory codes and required to be adhered to strictly.

This paper deals the different areas of working of States Factory Inspectorate Deptt., Boiler- Inspectorate & Deptt. of Explosives ,with particular reference to the NDT -Perspectives , their applications , comparative importance of various NDT techniques plus The Inspection & QC requirements .However their ultimate aim is identical and Un- disputable ,i.e .**No loss to Human lives, No damage to Property and NO damage to environment .**

Key words: Statutory Codes Acts, Time frame , Inspection cycle ,Mandatory requirements .NDT-Perspectives.



There are basically two types of Codes (1) **Statutory Codes** & (2) **Non-Statutory Codes** .The Statutory codes are (i) Factory Act-1948 in conjunction with the Rules of the respective states ,(ii)The Indian Boilers Act -1923& its counterpart Indian Boiler Regulations [IBR] `1950 (iii) **The Indian Explosives act-1884 in conjunction with Explosives Rules 2008** and the fourth is Atomic Energy Act - AERB [Atomic Energy Regulatory Board] .

The Non- Statutory Codes being ASME codes [various sections], IS Codes, British Codes Namely BS -5500, AWS D1.1, RTD, JIS & TEMA etc.

Coverage of Industries under different Codes & Acts

The Figures indicated below shows the coverage of industries in India in percentage.

S.No.	Name of the Act , Rules & Regulations	% Coverage of Industries
1	Factory Act-1948 along with Factory Rules of the states	92 to 95 %
2	Indian Boiler Regulations [IBR]- 1950	3 to 5 %
3	The Indian Explosives Act - 1 to 1.5	1 to 1.5 %
4	The Atomic Energy Act [AERB]	< 0.5 %

Salient features of Statutory Codes

- Safety and Welfare of the personal / employees working in these industries is of paramount importance & the basic philosophy is **Human Lives must be saved at all costs.**
- The Statutory Codes are in form of Acts promulgated by the Govt. and passed in the parliament with formulation of a set of Laws, Rules, Regulations & Code of conduct and passing of specific guide lines.
- The laws are not only mandatory in nature but carry legal value. The laws and the rules are framed in such a way that in case, the user whether industry owner ,Product Manufacturer ,Authorised Inspector and all other associated bodies can be brought to the court of Law. There is provision for punishment if the user violates these Rules.
- These Laws are en force able.
- Prevention of environment & Properties inform of machines, equipments, buildings are equally important under these codes .
- **These Codes are country specific.** These Acts cover whole of India(except the state of Jammu & Kashmir)

Salient features of Non- Statutory Codes

- These codes serve as **guide lines** for Fabrication of equipment, Product Manufacturer Authorised inspection Agencies and all other associated bodies.
- These codes are not en force able .The User and the consultant may use their discretion and reach an agreement with respect to the Rules framed in these codes.
- **These codes are not country specific.** And being followed by a large number of countries and the states all over the world.

- The code is not a hand book and cannot replace education, experience and the use of engineering judgement.

Technical note : The phrase engineering judgement refers to technical judgement made by knowledgeable designers experienced in the application of code . The engineering judgements must However be consistent with the code philosophy and judgement must never be used to overrule Mandatory requirements or specific provisions of the code.

[1] The Factories Act- 1948 [Act No. LXIII] - 23rd of September-1948

Salient Features of Factory Act.

1. The Factory Act covers maximum number of industries in country in all the states.
2. The Govt. Factory Act -1948 along with the States Factory Rules govern 92 to 95 % of all industries.
3. The Activities covered under this act are wide with formulation of Rules and Regulations on workers welfare, Safety , wages, working times , Schedules , Over time payments , Cleanliness , Night shifts , Welfare of women. And rules on even minute events in the Factory premises.
4. More importantly the Factory Act is An Act to consolidate and amend the law regulating the Labour in Factories.

Short Title, Extent & Commencement

This act may be called the **Factories Act-1948**

- It extends to the whole of India
- It shall come in to force on the 1st Day of April- 1949

Interpretation: Some of the important terms and definitions are given below

- (a) “Adult” means a person who has completed his eighteenth year of Age
 - (b) “**Adolescent**” means a person who has completed his fifteenth year of Age but has not Completed his eighteenth year
- [(bb) “**Calendar year** “ means the period of 12 twelve months beginning with the First Day of January in any year .]
- (c) “Child” means a person who has not completed his fifteenth year of Age.”
 - (ca) “**Competent Person**” in relation to any person of this Act , means a person or an institution recognised as such by the Chief Inspector for the purposes of carrying out tests , examinations and inspections referred to be done in a Factory under the provisions of this act having regard to
 - (i) The qualifications & experience of the person & facilities available at his disposal.
 - (ii) The qualifications and experience of the persons employed in such institutions and facilities available there in with regard to the conduct of such tests, examinations and inspection and more than one person or institution can be recognised as a competent person in relation to a Factory.
 - (cb) “**hazardous process** ” means any process or activity in relation to an industry specified in the 1st schedule where , unless special care is taken , raw materials used there in or the intermediate or the finished products , bye products, wastes or effluents thereof would
 - (i) Cause material impairment to the health of persons engaged in or concerned with or
 - (ii) Result in the pollution of the general environment.
- And many other terms and definitions are given in the Factory Act.

- The act and the provisions may be defined or altered and additions or omissions may be made by the State Govt. by notification in the official Gazette for any amendment in the 1st schedule

The Inspecting Staff

Chapter II of the Act defines the Inspecting staff, Powers of Inspectors, & Certifying surgeons.

Rule - 8 Inspectors (1) The state Government may by notification in the official Gazette, appoint such persons as possess the prescribed qualification to be inspectors for the purposes and may assign to them such local limits as it may think fit.

(2) The state Government may by notification in the official Gazette, appoint any person to be Chief Inspector who shall in addition to the Powers conferred on as chief Inspector under this act, exercise the powers of an inspectors throughout the state.

(2 A) Likewise additional Chief Inspectors, Joint Chief Inspectors and Dy. Chief Inspectors are selected and their duties are defined.

(2B) Every additional Chief Inspectors, Joint Chief Inspectors and Dy. Chief Inspectors and Every other officer appointed under sub-section (2A) shall in addition to the powers of a Chief Inspector specified in the notification by which he is appointed, exercise the powers of an inspector throughout the state.

(4) Every District Magistrate shall be an Inspector for his district.

9. Powers of Inspectors : Rule 9 of the Act says that subject to any Rules made in this behalf, an Inspector may within the local limits for which he is appointed

- a) enter, with such assistants, being persons in the service of the Government or any local or public authority, [or with an expert] as he thinks fit, any place which is used, or which he has reason to believe is used, as a factory
- b) make examination of the premises, plant, machinery, article or substance.
- (c) Inquire in to accident or dangerous occurrence whether resulting in any bodily injury, disability and take on the spot or otherwise statements of any person whom he considers necessary for such inquiry.
- (d) Require the production of any prescribed register or any document relating to the factory
- (e) seize or take copies of any register record or any other document as he may consider necessary in respect of any offence.
- (f) direct the occupier that any premises or any part thereof or any thing lying there in shall be left undisturbed (whether generally or in particular respects) as long as is necessary for the purpose of any examination.
- (g) take measurements & photographs & make such recordings as he considers as necessary for the purpose of any examination.

10. Certifying surgeons .The state Govt. may appoint qualified medical Practitioners to be certifying surgeons for the purpose of this Act within such local limits or for such factory or class or description of factories as it may assign to these respectively..

Chapter III of the Act deals about the **HEALTH**

11. Cleanliness : Every Factory shall be kept clean free from effluents arising from any drain, privy or other nuisance and in particular. Cleanliness must be maintained in all respects in the Factory precincts as well as in the surroundings and in the adjacent areas

The Act has framed Rules about all other aspects on cleanliness under Rules 12 to 20 like

Disposal of Wastes & Effluents', Ventilation, Temperature , (14) Dust & Fume , (15) Artificial humidification ,(16) Overcrowding ,(17) **Lightening , (18) **Drinking water** etc**

- The very purpose of making these Rules is that the working conditions of the Employees must be Hygienic

Welfare:

Chapter V of the Act is devoted on the guide lines over the possible welfare schemes for workers like facilities for Washing , Storing & drying of cloths, Facilities for sitting , (45) Provision for First Aid Appliances , (46) Canteens (47) shelters ,rest room & Lunch rooms (48) Creches etc.

(49) Welfare Officers : (i) in every factory where in five hundred or more workers are ordinarily employed ,the occupier shall employ in the factory such number of welfare officers as may be prescribed to look after the welfare schemes of the workers .

Besides above , the Act also mentions about the **WORKING Time** for the Adults like Weekly Hours, Weekly Holidays , Compensatory Holidays , Daily working hours etc.

Intervals for rest , Spread over time, working in the **night shifts** and payments for **working in over time** .

Guide lines for Inspection ,Testing and Quality Control

A] Rules for Inspection of Pressure Vessels , Pressure Plants & Equipments .

- 65]** Safety measures for pressure Plant and vessels operated under pressure above atmospheric Pressure (1) In this rule
- a) Competent person , means person who is in the opinion of the Chief Inspector , capable by virtue of his qualification , training and experience of conducting a thorough examination and pressure tests as required , on a pressure vessel or plant and making a full report on its condition.
 - b) Maker means any person in whose name the pressure plant or pressure vessel is either manufactured under a patent or sold?
 - c) Pressure plants means the pressure vessel along with its pipings and other fittings operated at a pressure above atmospheric pressure .
 - d) Pressure vessel means any vessel subjected to or operated at a pressure greater than the atmospheric pressure .
- (2) Every pressure plant or pressure vessel used in any factory shall be
- (a) Properly designed on sound engineering practices
 - (b) Of sound construction and material and of adequate strength and shall be free from any defect : and
 - (c) Properly maintained in a safe working condition.
- (3) (i) Every pressure plant or pressure vessel shall be fitted with
- (a) Safety valve or any other effective device to ensure that the maximum safe working pressure shall not be exceeded at any time
 - (b) a suitable pressure gauge with a dial range not less than 1.5 times and not exceeding twice the maximum safe working pressure shall be fitted conveniently so as to be visible clearly.
 - (c) Suitable stop valves or valves by which pressure vessel or system of pressure vessels may be isolated from other vessel or from the source of supply of pressure
 - (d) A suitable nipple and glove valve connected for the exclusive purpose of attaching a test pressure gauge for checking the accuracy of the pressure gauge

- (e) A suitable drain cock or valve or a plug at the lowest part of a pressure vessel so as to ensure effective draining of liquid that may be collected in a pressure vessel.

NDT Perspectives of Factory Act in conjunction with the Factory Rules of the State

1. Factory Act lays maximum importance on visual examination (both external and internal) . It is evident from the fact that this Act calls for thorough external examination of all pressure vessels , Pressure Plants & Equipments at an interval of six months and that the reports be submitted to the Client by the Competent Person Who carry out the said examinations .
2. This Act calls for internal examination of Pressure vessel on annual basis.
3. The Factory Act attaches significant importance to Hydrostatic Tests of Pressure Vessels / Equipments for leak tests and evaluation of structural integrity of the vessel under test and examination..
4. Factory Act does not recognise Pneumatic pressure testing of pressure vessel primarily owing to two reasons (i) leaks may not be detected at all the points And (ii) danger of mishap in case the pressure vessel bursts.

Schedule of Inspection & Inspection Cycle Under Factory Act.

SNo.	Activity	Schedule of exam./ tests ,Inspection cycle
1	External examination of pressure vessel / Pressure Plant or equipment .	Half yearly
2.	Internal examination of pressure vessel / Pressure Plant or equipment .	Yearly
3	Hydrostatic testing of pressure vessel / Pressure Plant or equipment .	Once in four years if internal exam is done annually. A) Once in every two years if internal exam is not done annually.
4	Ultrasonic Thickness testing	To be done annually (optional and require Factory Inspectorate's permission in lieu of other tests
5	Exemptions from tests	In case the pressure vessel is not made available owing to some process conditions or constraints ,a request is to be made to the Factory Inspectorate Deptt citing the reason and exemptions may be granted by the Chief Inspector of Factory of the State/.
6	Other NDT tests & Examinations	Though the Act has not made any direct references for Conducting other NDT tests like UFD, MPI ,RT & LPT etc However it has mentioned that for required of the Pressure Vessels during construction / fabrication the materials shall be of standard grade and quality And all the standard Fabrication codes Like ASME / IS / JIS may be used . These codes Used all the common NDT techniques particularly RT, UFD , LPT & MPI tests & examinations .

[2] Indian Boiler Regulations [IBR]

On 15th of Sept.1950 in New Delhi, in the exercise of Powers conferred by section 28 of the **INDIAN BOILERS ACT-1923 [V of 1923]** & in supersession of Govt Of India Notification no A 470 Dt. the 27th of Oct-1923 at SIMLA, the **Central**

Boiler Board is pleased to make the following Regulations, the same having been Previously published as required by sub-section [1] of section 31 namely regulations

Short Title, Extent, Application & Commencement

- 1] These Regulations may be called the, Indian Boiler Regulations -1950
- 2] They extend to the whole of India [except the state of Jammu & Kashmir]
- 2a] these regulations shall apply to all Boilers including those working on Principles of Natural Circulation, forced circulation, forced flow with no fixed steam & waterline
- 3] They shall come into force at once

Definitions

- a] The act means the Indian Boilers Act.
 - bb] Appraisal committee , means a Committee constituted Central Boilers Board
 - A] Technical advisor [Boilers] - Chairman
 - B] five Chief Inspectors or Director of Boilers from States
 - C] Five members from Board representing Central Govt. or Bureau of Indian Standard or Boilers or Boiler component manufacturers or National Laboratories or Engineering Consultancy Agencies
- The Secretary of Boilers Board shall nominate the members

3. General requirements, application of standard condition & exception thereto

3.3 No structural part of a Boiler ,which is subject to Pressure shall be made of Bessemer Process steel or of a Cast or Malleable Cast Iron

4] Where no specific provision is made in these regulations for design or manufacture of any pressure part ,the Inspecting Authority may permit the design ,manufacture , stage inspections and certification of such pressure parts including valves, mountings or fittings conforming to the codes or standards like **BS, ASME Boiler & Pressure vessel code TEMA, TRD or JIS** . Which are known to be commonly used in industrially advanced countries However ,the decision of inspecting authorities shall be binding .

4.a The tubes of boilers and Heat exchangers made of Titanium and other exotic metals may be approved as per internal codes like ASME,BS,DIN,TEMA with the minimum thickness specified in those codes of manufacture.

Thus article 4 & 4a clearly indicate that whatever NDT technique is followed under these codes , the same are applicable for IBR as well.

3A Inspection of Boiler to comply with any foreign code

Notwithstanding anything contained in these regulations , the inspecting authorities may inspect any Boiler meant for export during the various stages of its construction so as to comply with requirements of any foreign code and may grant a Certificate in Form IIA

3B Exemption of Boiler or Boiler components .

As per the provisions of sub section (3) of section 34 of the said Act any Boiler or Boiler component may be exempted in the whole or any part of the state from the operation of all or any part of the provisions of the act subject to the following conditions

- A] Design & construction of boiler or boiler component is in accordance with International code or Standard including British Standard [**BS**], **ASME,TEMA** , Technical Requirements Document [**TRD**] & Japanese Industrial Standard [**JIS**]
- B] Materials used in construction are not specifically prohibited by the said regulations
- C] The design, construction of boiler or boiler components have been satisfied by the state Governments of necessary test and examination like **RLA** examination

- 4. Standard Requirements** : deals with a] Materials b] Manufacture
- b.1] All boilers during manufacture shall be under the supervision of COMPETENT Person & be inspected at all stages prescribed in APPENDIX J
- b.2] All welders engaged in welding of boilers, boiler components , economisers , feed pipes steam pipes and super-heaters shall possess certificate in Form-XIII
- c] Certificates , Drawings or specifications :

A certificate in Form III of manufacture and test by the maker or by the representative of the maker of boiler containing the description of boiler , its principal dimensions , type of material , thickness of plates or the diameter of and the method of making the shell .

Seamless Ferritic Pipes For High Temperature Service

52 General

- (i) These regulations cover both Hot finished and cold drawn seamless pipes of ferritic alloy steel grades .
- (ii) Seamless pipes conforming to other national / international standards which are known to be commonly used as being suitable for High temperature service can also be used with the designations of national / international standards provided such materials are not specifically prohibited.
- (iii) While making pipes to other national / international standards the allowable stresses of respective standard shall be strictly followed while designating tubes.
- (iv) The design metal temperatures shall not exceed the following limits.

Material Grade	Temperature	
	Degree C	Degree F
P1,P2	537	1000
P5,P9,P11,P12 , P22 , P91 X 20 Cr Mo V 121	648	1200

53 Material

- (i) The pipes shall be seamless and manufactured from steel produced by a n open hearth or Electric Process or of the Oxygen Processes. The steel shall be Fully Killed
- (ii) The Steel shall conform to the limits of the Chemical composition

TABLE NO 4 Chemical Requirements for ferritic Steel (Few important grades)

Grade	Chemical Composition									
	C	Mn	Si	S	P	Cr	Mo	V,	Ni	others
P1	0.10 0.20	0.30 0.80	0.10 0.50	0.025 max	0.025 max	----	0.44 0.65			
P5	0.15 max	.030 0.60	0.50 max	0.025 max	0.025 max	4.0 6.0	0.45 0.65			
P11	0.05 0.15	.030 0.60	0.10 1.00	0.025 max	0.025 max	1.0 1.50	0.44 0.65			
P22	0.05 0.15	.030 0.60	0.50 max	0.025 max	0.025 max	1.90 2.60	0.87 1.13			
P91	0.08 0.12	.030 0.60	0.20 0.50	0.01 max	0.02 max	8.0 9.50	0.85 1.05	0.18 0.25	Nb=0.06-0.1 N= 0.030/0.07	

									Ni= 0.40 max Al= 0.04 max
X20Cr MoV121	0.17 0.23	1.0 Max	0.50 max	0.03 max	0.03 max	10.0 12.5	0.80 1.20	0.25 0.35	-----

The other parameters are (b) Heat Treatment (c) Workmanship & Tolerance

54 The mechanical Properties Requirements are shown in the Table 5

(a) Tensile tests, (b) Bend test & (c) Flattening test

55. Additional tests before rejection

56 . Hydraulic tests

(i) Each pipe shall be tested by the manufacturer and shall withstand a Hydraulic pressure to one and Half times the design Pressure but not greater than the pressure calculated by the following formula given below

$$P = \frac{2St}{d}$$

Where P = test pressure
D = Specified OD of Pipe
t = Specified wall thickness of pipe &
S = stress which shall be taken as 40 % of the minimum tensile strength at Room temperature

56 A Seamless Chromium Molybdenum Steel Boiler and Super Heater Tubes for Design Metal Temperatures not exceeding 577 degree C [1070 degree F]

Material: The tubes shall be manufactured from steel produced by the Open hearth or Electric process or any of the Oxygen process and shall conform to the following limits of Chemical composition

The steel maker shall prove to the satisfaction of the inspecting authority that the quality of the steel is of required high temperature creep strength

%	0.15 max
C	0.30 to 0.70
Mn	0.1 to 0.5
Si	0.1 to 0.50
S	0.04 max
P	0.04 max
Cr	1.90 to 2.60
Mo	0.87 to 1.2

NDT Perspectives of INDIAN BOILERS ACT-1923 [V of 1923] in conjunction with Indian Boiler Regulations [IBR]

The inspection schedules , Periodicity and NDT activities for Boilers & Boiler Components

S.No.	Job / Item Particulars	Type of Inspection Application of NDT	Schedules / Periodicity	Recommendations /Remarks
1.	Boiler Drums	Visual Examination Ultrasonic Thickness survey Hydrostatic testing	Annual or during S/D [shut-down] with prior intimation & permission of Boiler Inspector	Final Report should be acceptable.
2	Boiler Tubes	Visual Examination Ultrasonic Thickness survey Hydrostatic testing	Annual or during S/D [shut-down] with prior intimation & permission of Boiler Inspector	Final Report should be acceptable.
3	Boiler Drums & Boiler Tubes + Its connected components & Equipments	RLA Exam. [Residual Life Assessment -Visual Examination -Thickness survey -UFD of weld joints -MPI of all fillet joints & Support pads -Insitu- Metallography of Tubes & Boiler Drum shell -In-situ Hardness tests -Inspection of support systems & connected fitments / piping -Hydrostatic tests	Once if Five years or earlier with prior permission of Boiler Inspector / Chief Boiler Inspector or as per his advice . In case any kind of material degradation is suspected during physical examination of Boiler & Boiler Tubes Advice for RLA may come from Boiler Inspectorate Deptt.	These tests shall be conducted by the experienced party along with testing / Exam Procedures and the same to be submitted to the Boiler Inspector to his satisfaction.
4	NDT inspection Of weld joints Of Boiler Shell & Tubes	Radiography using Gamma Ray isotope	For new weld Jts + For repaired Joints of Boiler Tubes	100 % Joints required to be radiographed
5	Welders Test Pieces	All weld metal tests . Impact tests & all other mechanical test s as per Std. Spec.	NDT - includes RT of the weldments [Butt joints]	Must pass in all the tests as is required under the international code .

[3] Explosives Act -1884

An Act to regulate the manufacture ,possession, use, sale [(2) transport, import , export] of explosives.

Whereas it is expedient to regulate, the manufacture ,possession, use, sale [(2) transport, import , export] of explosives. It is hereby enacted as follows

Short Title : The act may be called the explosives act
It extends to the whole of India

2. Commencement (1) This Act shall come in to force on such day as the Central Govt. by notification in the official gazette appoints

Definition in this act under the context otherwise requires

- (a) “aircraft ” means any machine which can derive support from reactions of the air ,other than the reactions of an air against the earth’s surface and include ballons, whether fited or free , airships, kites. Gliders and flying machines.
- (b) “ carriage :” include any carriage , wagon, cart, truck , vehicle or other means of conveying gods or passengers by land in whatever manner the same may be propelled

- (c) District Magistrate : in relation to any area for which a commissioner of police has been appointed means the Commissioner of police there of and includes (a) such as Dy Commissioner of police exercising jurisdiction over the whole or any part of such area as may be specified by the state Govt. in this behalf in relation to such area or part and (b) an additional District Magistrate .

The other terms like Explosives,, Export, Import, Master etc have also been used under these articles frequently along with definitions .

The explosives Rules 2008

Preliminary

1. **Short Term and commencement** (1) . These Rules may be called the Explosives Rules 2008 (2) They will come in to force on the date of this publication in the official gazette.

The Petroleum Act, 1934

[Act no 30 of 1934]

And

The Petroleum Rules 2002

The Petroleum Act ,1934 (Act No. 30 of 1934) - The Indian Petroleum Act 1899, was passed at a time when the use of Petroleum , particularly of dangerous petroleum or Petrol was limited and with the great developments in the use of petroleum that have taken place in the last 30 years it has become un-suitable in several ways .As early as 1903 , the attention of the Government of India was drawn to the in convenience of arising from the existence in different provinces of different sets of rules to regulate the importation, possession and transport throughout British India and the only way it has been possible to secure uniformity has been by the issue by local Governments from time to time of similar rules with sanctions of Central government and the interests concerned were consulted of the subject of revising the act in 1925-26 and it was agreed by all local governments that the Rule making power should be transferred to the Central Government.

2 The opportunity has been taken to rearrange the whole Law. *In addition to the “preliminary” portion and the final supplemental chapter, the Bill contains three separate chapters.* Chapter I relates to the control of petroleum and chapter II to its testing while chapter III contains the necessary penal provisions and what may be described as criminal procedure

PRELIMINARY

1. **Short Title , extent and commencement** (1) This act may be called the Petroleum Act 1934
2. It extends to the whole of India
3. It shall come in to force on such date as the Central Government may by notification in the official gazette , appoint

2. Definitions

- (a) “ petroleum “” means any liquid hydro-carbons or mixture of hydr carbons and any inflammable mixture (liquid , viscous or solid)containing any liquid hydro carbon.
- (b) “ Petroleum Class A “ means petroleum having a flash point below 23 degree C.
- (bb) Petroleum Class B “ means petroleum having a flash point below 23 degree C.and above but below 65 degree C
- (bbb) Petroleum Class C “ means petroleum having a flash point 65 degree C.but below 93 degree C
- (c) [flash point] of any petroleum means the lowest temperature at which it yields a vapour which will give a momentary flash when

Production , refining and blending of Petroleum (1) No one shall produce , refine or blend petroleum save in accordance with the Rules made under sub- section [2]

- (2) The central Government may make rules
- (a) Describing the conditions subject to which petroleum may be produced , refined or blended and
- (b) regulating the removal of petroleum from places where it is produced , refined or blended and preventing the storage therein and removal there from ,except as [Petroleum Class A] of any petroleum which has not satisfied the prescribed tests

Transportation of Petroleum is done through Water , Land & Air .

Bulk transportation is done through water in Barges & Flats followed with Transportation on Land through Tankers .An other important means of Transportation is done through Pipe lines

Transport by pipe lines :

- 88.** Right of way to be acquired : No pipe line and installation connected with a pipe line shall be constructed without acquiring the necessary land, lease agreements , and right for construction thereof and the unhindered access there to for inspection, maintenance repairs, replacements and patrolling
- 89** Approval of the design and route of the pipe line -(1) No pipe line shall be laid without written approval of the Chief Controller of the route of the pipe line and of the design, construction and the working there of
- (2) Where the approval of the Chief Controller is sought for laying of a pipe ;line , the person desirous of laying the pipe line shall submit to the chief controller
- (i) A comprehensive project report , accompanied by all necessary drawings , calculations giving references to recognised code or codes followed by , giving details of the design , construction and testing of the pipe line and its components , the route along which the pipe line will be laid and he manner of laying , the class or the classes of petroleum is to be transported in the pipe line and provisions proposed to be made for the maintenance and patrolling of the pipe line.
- (ii) A scrutiny fee of Rupees five hundred shall be charged .

Inspection and Testing of Pipe Lines

92] Protection against corrosion . The pipe line shall be protected against corrosion by suitable coating strapping and where necessary by cathodic protection.

93] Hydrostatic testing of pipe lines (1) before transporting petroleum for the 1st time , each pipe line or completed sections there of shall be filled with water and the pressure in the line or the section , as the case may be raised to 1.1 timed the design internal pressure and maintained for a period of at least 24 hours .or as per the procedure laid down in the relevant pipe line design code recognised by the Chief Controller A pipe line or section there of showing any significant drop of pressure during the period of testing shall not be used for transporting petroleum until necessary repairs have been carried out and satisfactory re-test done.

100 . Power of Inspection and examination : The chief controller or controller may at any time inspect and examine any pipe line and the owner there of or persons operating or using the pipe line and the persons on whose line such pipe line is situated or his representative shall facilitate such inspection and examination and answer all the queries of Chief controller or controller in regard d to such pipe line

The Gas cylinder Rules - 2004

Whereas a draft of the Gas cylinder Rules 2003 was published as required by section 18 of Explosives Act 1884 (4 of 1884) in the gazette of India, extraordinary Part II, Section 3 Sub-section 0(i) dated 20th October 2003 vide notification of the Government of India in the Ministry of Commerce (Department of Industrial Policy and Promotions) no GSR 822(E) dated 20th October 2003, inviting objections and suggestions from all persons to be affected there by

And whereas the said gazette was made available to the public on the 20th October 2003

And where as the objections and suggestions from the public on the said draft Rules.

Now therefore in the exercise of powers conferred by section 5 and 7 of the Explosives Act 1884(4 of 1884) and in supersession of the gas Cylinder Rules, 1981, except in respect things done or omitted to be done before such supersession, the Central Government hereby makes the following Rules

Preliminary

1. Short title & commencement (1) These Rules may be called the Gas Cylinder rules 2004

(2) they shall come in to force on the date of their publication in the official Gazette

2. Definitions - In these rules unless the context otherwise requires

(i) “**Act**” means the Indian Explosive Act 1884(4 of 1884)

(ii) “**Auto LPG**” means liquefied petroleum gas meant for automotive fuel conforming to specification IS 14861

(iii) “**Chief Controller**” means the Chief Controller of Explosives, Govt. of India

(iv) “**Composite cylinder**” means a cylinder made of resin impregnated continuous filament wound over a metallic or a non-metallic liner. Composite cylinders using non-metallic liners are referred as to as all-composite cylinders

(v) “**Compressed gas**” means any permanent gas, liquefiable gas or gas dissolved in liquid under pressure or gas mixture which in a closed gas cylinder exercises a pressure either exceeding 2.5 kgf/cm² abs (1.5 Kgf/cm² gauge at + 15 degree C or a pressure exceeding or a pressure exceeding 3.0 kgf/cm² abs (2.0 Kg gauge) at + 50 degree C or both

(**xxxviii**) “**Test Pressure**” means the internal pressure required for the Hydrostatic test or Hydrostatic stretch test of the cylinder as follows

(1) For permanent and high pressure liquefiable gases, it should be calculated from the following

$$Ph = \frac{200 \cdot t \cdot Re}{1.25 (Do - t)}$$

Where Ph = Test pressure in Kgf/cm²

Do = Outside diameter of cylinder in mm

T = minimum calculated wall thickness of the cylinder shell in mm and

Re = Minimum specified yield strength of the material of the cylinder in Kgf/mm². It is limited to 75% of the minimum value of the Tensile strength in the case of normalised cylinder & 85 % of T.S. for quenched and tempered cylinder, provided that the value of the test pressure shall not exceed 80% of the Yield strength.

Some of the additional important features of Gas Cylinder Rules are the followings
[4] Valves , [5] Safety Relief Devices [6] marking on cylinders [7] markings on valves [8] Identification colours [9] Labelling of cylinders [10] Restrictions on delivery or despatch of cylinders [11] repairing of seamless gas cylinders during use [12] Repairing of welded or brazed cylinders + [14] Prohibition of smoking, fires, lights and dangerous substances [15] general Precautions & [18] Handling and use etc

[4] Atomic Energy Act -1962 **&** **[Atomic Energy Regulatory Board-AERB]**

The Atomic Energy Act -1962 [No 33 of 1962]

An Act to provide the development , control and use of Atomic Energy for the welfare of the people of India and for other peaceful purposes and for matters connected therewith
Be it enacted by Parliament in the thirteenth year of the Republic of India.

1. Short title & commencement

- (1) The act may be called the atomic energy Act 1962
- (2) It extends to the whole of India
- (3) It shall come in to force on such date as the central Government may by notification in the official Gazette , appoint

2. Definitions & Interpretations

- (1) In this act , unless the context otherwise requires
- (a) “ **atomic energy**” means energy released from atomic nuclei as a result of any process fission or fusion.
- (b) “ **fissile material**” means U-233, U-238, Plutonium or any material containing these substances or any other material that may be declared as such by notification by the Central Government
- ++(bb) “ **Govt. Company** ” means a company in which not less that 51 % of the paid up share capital is held by the Central Government .
- (c) “ **minerals** ” include all substances obtained from the soil (including alluvium or salts)by underground or surface working .
- (g) “ **prescribed substances** ” means any substance including any mineral which the Central Government by buy notification prescribe being a substance which in its opinion is or may be used for the production or use of Atomic Energy or research in to materials connected therewith and includes **U, Pu, Th, Be , deuterium** or any of these respective derivatives or compounds or any other materials containing any of the aforesaid substances.

[Atomic Energy Regulatory Board-AERB]

The Atomic Energy Regulatory Board was constituted on Nv-15, 1983 by the President of India by exercising the powers conferred by section 27 of the Atomic Energy Act 1962 [33 of 1962] to carry out certain regulatory and safety functions under the act..The regulatory authority of AERB is derived from the rules and notifications promulgated under the Atomic Energy Act 1962 and the environmental protection act 1986 . Headquartered at MUMBAI .

The mission of the Board is to ensure that the use of ionising radiations and nuclear energy in India does not cause undue risk to Health and environment.

AERB is supported by Safety Review Committee for Operating Plants [**SARCOP**], The Safety Review Committee for Application of radiation [**SARCAR**]and Advisory Committee for Project Safety Review [**ACPSRs**]

The **SARCOP** carries out the Safety Surveillance and enforces safety stipulations in the operating units of DAE . The **SARCAR** recommends measures to enforce radiation safety which use radiations and radioactive substances ,

INSPECTION , QC REQUIREMENTS & NDT PERSPECTIVES

The Department of Atomic Energy [DAE] and all its Units like B.A.R.C [Bhabha Atomic research Centre], Heavy Water Plants, All the Atomic Power Plants , NPCIL [Nuclear Power Corporation of India belongs to the Central Government which is fully empowered to make rules Concerning Research , Production and use of the Nuclear Energy obtained from the Nuclear Installations the way it wants to use for the welfare of the people of India .

- Among all the Four types of the Statutory Codes ,mentioned above in this paper , The Atomic Energy Act-1962 in conjunction with the Atomic Energy Regulatory Board 1983 , the specifications and the quality requirements are very stringent . All the materials required to be used for generation of the Nuclear energy must be totally free of defects .
- And this requires application of all conceivable NDT techniques , Right kind of Procedures & methodologies like UFD, RT, LPT, Eddy current Testings , Visual examinations , [MPI as well in certain cases] . The advanced methods like phased array technique, Time of Flight techniques are commonly used to ensure that the end product matches the highest quality standards set by International Codes & standards .ASME Section III , ASME Section VIII Divn 2 and IAEA [International Atomic Energy Agency] guide lines on the Safety standards and product quality are the essential requirements and are the driving force so far as the Application of Atomic Energy Act is concerned with regards to QA/QC & NDT requirements.
- Since the operating conditions are very severe in the nuclear Reactors nothing can be left to any chance of failure.

Conclusion:

The study of the statutory Codes reveal that they are vast in content in the respective fields . The Factory Act 1948 along with states Factory rules is devoted to the welfare of workers,, their wages /emoluments and making provisions for improvements in the general working conditions in Factory premises. In regards to inspection methodologies applicable for quality assessment of Pressure vessels ,equipments and Lifting machines and safety appliances it is observed that Factory Act gives greater importance to Visual examination followed with Hydrostatic Testing..

The Indian Boilers Act-1923 along with IBR lay greater emphasis on use of materials and testing techniques both Physical testing and Non -destructive evaluation as prescribed in standard National and International Codes . Radiographic testing preferred against UFD of the weld joints of Boilers / Boiler Tubes and welders Performance evaluation. For overall quality assessment of Boiler Systems RLA Examination [**Residual Life assessment**] is asked for .The safety of the Boiler system to save human lives is of paramount importance and any compromise is not done in regards to the ultimate quality of the System generating steam..

The Petroleum Act -1934 along with Petroleum Rules , The Explosive Rules and Gas Cylinder Rules all demand still a higher degree of quality control on all the manufactured products used in handling and transporting Gases in all forms and from all the modes of Transport . In regards to NDT perspectives, all gaseous handling equipments , Petroleum Products and their derivatives demand thorough periodic examination & testing .

The Atomic Energy Act -1962 in conjunction with the **Atomic Energy Regulatory Board** [AERB] deal with the formulation and execution of Rules for safety of all installations generating Nuclear Power , in Research establishments ,and for protection

against Radiations emanating from Radioactive substances. The QC requirements exercised are of the highest level .Material selection, testing and evaluation are done with the help of International codes & standards.. All possible NDE techniques are used along with views of experts before arriving at the decision of using the nuclear component.

The ultimate aim under all the above Acts is identical and Un-disputable ,i.e. **No loss to Human lives, No damage to Property and NO damage to environment .**

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