Guidelines on
Field Inspection, Handling and Testing of Casing Pipe &
Tubing

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Guidelines on
Field Inspection, Handling and Testing of Casing Pipe & Tubing

Prepared by:
Functional Committee
On
Field Inspection, Handling and Testing of Casing Pipe & Tubing

OIL INDUSTRY SAFETY DIRECTORATE
8th Floor, OIDB Bhavan,
Plot No. 2, Sector - 73
Noida – 201301 (U.P.)
Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate
FOREWORD

The Oil Industry in India is more than 100 years old. Because of various collaboration agreements, a variety of international codes, standards and practices have been in vogue. Standardisation in design philosophies and operating & maintenance practices at a national level was hardly in existence. This coupled with feed back from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas units.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) manned with experts from within the industry in formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safe operations. Accordingly, OISD constituted a number of functional committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The present guidelines on "Field Inspection, Handling and Testing of Casing Pipe & Tubing" was prepared by the Functional Committee. This document is based on the accumulated knowledge and experience of industry members and the various national and international codes and practices.

This guidelines is meant to be used as supplement to existing codes and practices. It is hoped that provisions of this guidelines, if implemented objectively, will go a long way to improve the safety and reduce accidents in Oil and Gas Industry.

Suggestions are invited from the users after it is put into practice to improve the document further. Suggestions for amendments to this document should be addressed to:

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COMMITTEE
FOR PREPARATION OF GUIDELINES ON
"Field Inspection, Handling and Testing of Casing Pipe & Tubing"

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1.0 INTRODUCTION

Casing pipe and tubing are lowered in the well from surface to provide lining to well and to produce well fluids or to inject fluids in the well respectively. These pipes play vital role in the completion of oil / gas wells and its performance is the key factor in successful completion of the well. Any failure in inspection & handling would lead to complications in the well and in few cases even to the extent of loss of well and human life. Therefore proper field inspection & handling practice is required to eliminate any such mishap.

These guidelines have been prepared with an aim to provide a comprehensive document detailing, field inspection and handling of casing pipe & tubing from the receipt of the same at stockyard to its lowering in the well in upstream sector.

2.0 SCOPE

This document stipulates the guidelines for field inspection and handling of casing pipes & tubing (including special services) during transportation & storage, inspection / preparation prior to lowering, landing procedures, testing procedures after its lowering in the well and precautions on reuse of retrieved casing pipes & tubing.

3.0 DEFINITIONS

Casing pipe: Steel / non-ferrous alloy pipe which is used to provide lining to the drilled hole and to protect the well from formation fluid flow or formation collapse. It is permanent part of the well in which bottom section of casing (partly or fully) is cemented. Casing pipes are classified based on its usage like conductor pipe, surface casing, intermediate or protective casing and production casing. These casing strings are extended to the surface.

Connection: Threaded ends of tubular components.

Coupling: Internally threaded cylinder for joining two length of pin threaded pipes.

Drift Diameter: Maximum allowable cylindrical diameter to pass through the inside diameter of a pipe.

Dunnage: Light material stowed or packed under the load to protect it from damages.

Electric welded pipe: Pipe having one longitudinal seam formed by electric resistance or electric induction welding, without the addition of filler material.

Freeze Point: The point at the cement top of the cemented casing.

Liner: Section of the casing pipe, which is not extended to surface, is called a liner.

Nominal Weight: The average weight of pipe per unit length inclusive of the joint / couplings.

Premium casing / Tubing: Pipes having additional features over and above API standards.

Seamless pipe: Wrought steel tubular product made without a weld seam.
Specification of Casing pipes and tubing:
The following parameters comprise the specification of casing pipe and tubing:
- Outer Diameter
- Type of Connection and upset
- Grade of steel
- Weight in pounds per feet (PPF)
- Applicable standard for manufacturing i.e API std 5 CT and 5L (For some grades of 18 5/8” O.D. & larger)
- Range for length of pipes i.e. Range I, II & III
- Manufacturing process: - Seamless / ERW (Electric resistance Welded)
  Common sizes / type of casing pipes and tubing are illustrated in “Annexure I”

Thread compound: Substance that is applied to threaded pipe connection prior to make up, to provide lubrication during assembly and disassembly and to aid in sealing against high internal & external pressure in service.

Tubing: Innermost conduit made of steel/ non-ferrous alloy in a well through which well fluids are brought to the surface. Tubing can be removed from the hole as and when required.
Upset: Ends of the pipe having larger O.D./ I.D. or both where pin is machined to have couplings bucked on.

4.0 PRECAUTIONS FOR HANDLING DURING TRANSPORTATION & AT STOCKYARD
Casing pipes & tubing require careful handling during transportation and storage to prevent any damage to pipe body & precision threads. The following precautions should be observed while handling, transportation & storage:

4.1 Precautions for Handling
The following precautions should be observed while handling casing pipe and tubing:
- Pipes should always be handled with thread protectors in place.
- Pipes should not be dropped during unloading.
- Rough handling should be avoided as it may damage the threads or dent the pipe body.
- The pipes meant for sour service (i.e. H2S environment) and made of CRA (Corrosion Resistance Alloy) material, should be handled carefully. As any impact against adjacent pipe or other objects may cause a local increase in the hardness of the pipe to the extent that it becomes susceptible to sulfide stress cracking.
- Rope slings should be used to control the pipe while unloading by hand.
vi. Pipes should be rolled parallel to each other on the rack and not allow pipe to gather momentum or to strike the ends, because even with thread protector in place, there is danger of damaging the threads.

vii. Spreader bar with a choker sling(s) at each end should be used while handling long pipe. For more detail, OISD std. 187 should be referred.

4.2 Precautions during Transportation

4.2.1 Water Transportation
Proper care should be taken in respect of following points, while loading and unloading of water carriers.

i. Pipes should have sufficient dunnage and slewing to avoid rolling of pipes during ship movement.

ii. Pipes should have adequate bracing to prevent shifting during movement of the ship.

iii. Pipes should not be placed near hazardous / corrosive chemicals.

iv. Pipes should not be dragged along the pile as it may cause damage to the coupling / thread protector.

4.2.2 Rail / Road Transportation
The following prevention and measure should be taken while transporting through railway wagon/trailers:

i) Provide wooden stringers across the bottom to provide suitable support for pipe, to allow space for lifting and to keep pipe away from dirt.

ii) If the bottom of the car is uneven, the stringers should be rigidly shimmed so that their tops will be in the same plane.

iii) Stringers should not be placed under couplings or the upset part of pipe.

iv) The load should be tied down and bundled in case of tubing to avoid slippage.

v) Loaded pipes should be tied down with suitable chains at both ends. However for handling long pipe, an additional chain should be provided in the middle.

vi) Pipes should be loaded keeping all couplings on the same end.

vii) Care should be taken to prevent chafing of coupling / joint shoulders on adjacent joints.

viii) Trailer should be loaded adequately after considering the condition of old bridges etc. on the way, if any.

ix) Trailer should not be overloaded and load has to be as such that it can be delivered without intermediate / transit unloading.

x) After the load has been hauled a short distance, retighten load binding chains, which might have loosened as a result of the load settling.

4.3 Precautions in Storage
The following precautions are recommended for pipe storage:

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i. The first tier of pipe should be 18 inches & more from the ground to keep moisture and dirt away from pipe.

ii. Pipe should rest on supports properly spaced to prevent bending of the pipe or damage to the threads.

iii. The stringers should lie in the same plane and leveled. It should be supported by piers adequately to carry the full stack load without settling.

iv. Separators strips (wooden or ropes) should be provided between successive layers of pipe so that no weight rests on the couplings. Minimum three spacing strips should be used.

v. Spacing strip should be provided at right angles to pipe and directly above the lower strips to prevent bending of pipe.

vi. Stagger adjoining lengths of pipe in the tiers an amount approximately the length of the coupling.

vii. Pipe should not be stacked higher than 10 feet or five tiers for purpose of safety, ease of inspection, and handling.

viii. Pipes of different size, grade and weight should be stacked separately for ease of identification with proper marking.

ix. Pipe should be visually inspected periodically to ascertain corrosion, damage etc. and necessary precautions taken therein.

x. Pipes should be stored in stockyard to facilitate the clear movement of crane.

5.0 PREPARATIONS PRIOR TO LOWERING OF CASING PIPES AND TUBING

It is essential to inspect casing pipes and tubing at site prior to lowering in the well to take care the damage / defect incurred during transportation and storage. Additionally, inspection of handling tools, preparation of pipe tally etc. are also necessary before lowering of pipes as detailed in this chapter.

5.1 General precautions

i. The casing policy should be available at well site stipulating the design of the casing string. It should include the location of Float shoe & collar, short pipes, the various grades of steel, weight of casing & type of the connection etc.

ii. It should be ensured to lower the pipes in exactly the same order, as given in casing policy of well. In case the specification of any pipe is not identified, it should be laid aside until it is established.

iii. In case of lowering of mixed string, of different grade, weight etc., ensure that appropriate casing is accessible on pipe rack as per the program.

iv. In deep / critical wells, hydraulic testing of casing pipes should be carried out before lowering.

v. Pipes should always be handled at all times on the racks or on wooden or metal surfaces free of rocks, sand or dirt.

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vi. The threads should be cleaned and serviced again whenever pipes are inadvertently dragged in
the dirt,

vii. Every possible effort should be made to keep such damage at a minimum by using proper
equipment to prevent damage by slip & tong marks.

viii. It should be ensured that connectors / pup joints do have the adequate thread capacity to
support the load and are compatible to the size & type of casing / tubing.

ix. Pipes should be lowered or rolled on the walk without dropping. Rope snubbers may be used, if
necessary.

x. Pipes should not hit against any part of derrick or other equipment. Hold back rope should be
provided.

xi. The settling of pipes on bottom of the well or otherwise in compression stage, should be avoided
to prevent buckling of pipe.

xii. In order to ensure adequate hydrostatic head to balance formation pressure, the casing should be
periodically filled with mud while being run keeping a check on the weight of casing string.
Generally filling after every 5-6 joints should be adequate, however in no case should the
hydrostatic balance of formation pressure should be jeopardized by too infrequent filling. Filling
should be done with mud of the proper weight, using a conveniently located hose of adequate
size with quick opening and closing plug valve in another mud hose.

Note: - The foregoing mud fill up practice is not required if automatic fill up float shoes and collars
are used.

5.2 Preparation of Casing / tubing tally

i. A steel tape calibrated in millimeters should be used.

ii. The measurement of pipes should be made from the outermost face of the coupling to the
pin end, where coupling or the box stops when the joint is made up power tight as explained
below: -

- On round thread joints, this position is to the plain of the vanish point on the pipe;
- On buttress thread pipe, this position is to the base of the triangle stamp on the pipe;
- On extreme line casing, this position is to the shoulder on the externally threaded end.

iii. The measured length of each pipe should be written on the pipe with paint preferably near
the coupling end.

iv. Pipe tally should be prepared as per the format given as Annexure 2a & 2b

5.3 Inspection of Handling Tools:

Handling tools of appropriate size and capacity should be selected and planned its availability in
advance. Proper equipment in good condition is the key for a successful and trouble free
operation. Inspection of all handling equipment is necessary before starting the lowering of pipes.
Make shift arrangement shall not be done.

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Inspection of handling tools viz. Manual & Hydraulic Tongs, Hand slip, single Joint Elevators, Side door elevators, Heavy duty elevators, Spiders, Pup joints, Instrumentation at Driller’s console including Weight indicators & torque gauge etc., shall be carried prior to taking up lowering of casing pipe and tubing. For more detail OISD Std. 190 should be referred.

5.4 Preparation of Threads of Casing pipes and Tubing

The following precaution should be taken for preparation of threads of pipes for makeup in the strings.

i. Clean and inspect the threads.

ii. The pipes with damaged threads should not be used.

iii. Each coupling should be checked for make up before taking up the pipe to derrick. If the standoff is more, check the coupling for tightness. Loose couplings should be tightened after thoroughly cleaning the threads and applying fresh thread compound over entire thread surfaces.

iv. Thread compound should be applied to the entire internal and external threaded areas as recommended in API 5A2 or equivalent prior to stabbing.

v. Quick release coupling should be used while taking pipes from rack to derrick in order to avoid damage to threads of pin end.

vi. In case thread protector are used for taking up pipes from pipe rack to derrick, clean thread protector should be tightened on the pin end of the pipe so that thread will not be damaged. Adequate number of thread protectors duly cleaned should be available.

5.5 Drifting of casing and Tubing

Each length of casing should be drifted for its entire length before lowering in the well, with cylindrical mandrels conforming to specification given in Annexure 3. Casing that does not pass the drift test should be rejected with proper marking.

5.6 Straightness check

i. All pipes should be visually examined for straightness. Pipe sizes 4.1/2” and larger O.D. should be checked for straightness by using a straight edge or taut string (wire). Deviation from straight, or chord height, should not exceed either of the following:

   i. 0.2 percent of the total length of the pipe measured from one end of the pipe to the other end.
   ii. 0.125 inch in the 5-foot length at each end.

Measurement of the deviation should not be made in the plane of the upset and the upset fade away or the coupling area.

5.7 Field Makeup of Casing pipes

The following practice should be adopted for field make up of casing pipes:

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5.7.1 General precautions

i. Wobbling during make up lead to galling of threads. In case wobbling is observed while making up the pipes, it could be due to non-alignment of thread with the axis of the pipes. To stop wobbling, the speed of rotation should be decreased. If it still persists despite reduced rotational speed, the casing should be rejected.

ii. While making up the pin end, it is possible that coupling may rotate on the box end slightly. This does not indicate that the coupling on the box end is too loose but simply that the pin end has reached the tightness with which the coupling was screwed on at the manufacturer’s facility.

iii. In order to avoid shock loads during lowering of casing string, it should be picked up and lowered carefully with proper care while setting slips.

iv. Dropping a string even a short distance may loosen couplings at the bottom of the string.

v. Proper care shall be taken to avoid cross threading in initial makeup of 16” O.D. & larger connections.

vi. For premium casing pipes, recommended guidelines of the manufactures should be followed.

5.7.2 Casing Pipes of Round thread, size 4.1/2” through 13.3/8” O.D.

a) Prior to lowering of casing, it is necessary to determine the value of torque for proper make up. For recommended torque, Annexure 4 should be referred.

b) The torque values shown in Annexure 4, have been recommended makeup under normal conditions and should be considered as satisfactory provided the face of the coupling is within (+/-) two thread turns of the thread vanish point.

c) Casing should be made hand tight to the possible limit. For the proper number of turns beyond hand tight position the following is recommended:

- When conventional tongs are used for casing make up, tighten with tongs to proper degree of tightness.
- The joint should be made-up beyond the hand tight position at least three turns for sizes 4.1/2” through 7” and at least three and one half turns for sizes 7.5/8” and larger, except 9.5/8”and 10.3/4” grade P-110 and size 20” grade J-55 and K-55, which should be made up about four turns beyond hand tight position.

d) When using a spinning line, it is necessary to compare hand tightness with spin up tightness. In order to do this, makeup the first few joints to the hand tight position, then back off and spin up joints to the spin up tight position. Compare relative position of these two

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makeup and use this information to determine when the joint is made up the recommended number of turns beyond hand tight

e) The manual tong should be provided with a reliable torque gauge of known accuracy. In case any irregularities is observed during initial stage of make up, pipes should not be tightened as these may be indicative of crossed threads, dirty or damaged threads, or other unfavorable conditions.

f) The connections should be made up at a speed not to exceed 25 rpm to prevent galling while making up connections.

g) While making up the pipes, torque gauge should be observed and the approximately position of the coupling face with respect to the thread vanish point position as well.

h) While making up the pipe. If such situation is observed that the thread vanish point is buried in two thread turns only and 75 percent of the torque shown in table is not reached the joint should be treated as a questionable joint and should be rejected.

i) In case during makeup, several threads remain exposed when the listed torque is reached, additional torque may be applied up to 125 percent of the value shown in table of Annexure 4.

Pipe should be rejected, if three threads turns or more remain exposed even after this applying additional torque.

5.7.3 Casing Pipes of buttress thread, size 41/2” through 13.3/8” O.D.

For Casing connections of size 41/2” to 13.3/8” OD: Makeup torque values should be determined by observing carefully the torque required to makeup each of several connections to the base of the triangle, then using thus established the torque value for making up of balance pipes of that particular weight and grade in the string.

5.7.4 Casing Pipes of Round & Buttress thread, size 16” through 20” O.D.

i) For Buttress thread and round thread, sizes 16”, 18.5/8” and 20” OD: Makeup shall be to a position on each connection represented by the thread vanish point on round thread and the base of the triangle on buttress thread using the minimum torque shown in table of Annexure 4 as a guide.

ii) The base of the triangle, help in locating the thread vanish point for basic power tight makeup; however, the position of the coupling with respect to the base of the triangle shall not be a base for acceptance or rejection.

5.7.5 Field Makeup of Tubing

i. Joint life of tubing under repeated field make up is inversely proportional to the field makeup torque applied. Therefore, in wells where leak resistance is not a great factor, minimum field makeup torque values should be used to prolong joint life

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ii. In case of use of manual tongs for making up tubing, the recommended torque values for each size, weight and grades of tubing should be ascertained from Annexure 5.

iii. Assembly of tubing in the horizontal position should be avoided.

iv. Connections should be turned by hand to the hand tight position before slowly power tightening. The procedure should be reversed for disassembly.

v. For premium tubing, recommended guidelines of the manufactures should be followed.

5.8 ADDITIONAL PRECAUTIONS FOR TUBING BEFORE LOWERING:

i. The actual length of tubing string under tension should be obtained, giving due consideration to factor of elongation because of temperature and pressure.

ii. For high-pressure wells additional precautions should be taken to ensure that joints are sufficiently tight. For proper tightening, it should be ensured that, the coupling would float or make up simultaneously at both ends until the proper number of turns beyond the hand tight position have achieved. The hand tight position may be determined by checking several joints on the rack and noting the number of threads exposed when a coupling is made up with a proper torque. Full tight position is normally one turn beyond hand tight position.

5.8.1 Precautions during Pulling out of Tubing

i. When tubing is pulled in to the derrick, care should be taken that the tubing is not bent or couplings or protectors bumped. For stacking, one row of drill pipe’s stands should be kept at candle stand rack to support the tubing stands.

ii. Tubing set back in the derrick should be properly supported in the middle to prevent undue bending. Stands of tubing sizes 1.9 inch OD or smaller and stands larger than 60 feet should have intermediate support to prevent undue bending.

iii. Distribute joint and tubing wear by moving a length/ joint from the top of the string to the bottom each time, the tubing is pulled.

iv. In order to avoid leaks, all joints should be re-tightened periodically.

v. When tubing is struck, Tubing should not be stretched assuming that the tubing is free. It should be ensured that weight indicator is calibrated.

vi. After a hard pull to loosen a string of tubing, all joints pulled on should be re-tightened.

5.8.2 Field welding of attachments on Casing pipes and Tubing

Following precautions should be taken before taking up the welding job on casing pipes and tubing.

i. Field welding may have adverse effects on various types of steels used in all grades of casing pipes and tubing unless due precautions are taken.

ii. Welding on high strength steel should be avoided, as the heat from welding may affect the mechanical properties of high strength steel.

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iii. Welding is not recommended on critical portions of the string where tension, burst or collapse strength properties are important.

iv. Welding of Float Shoe / collar with joint shall be done only with extreme caution.

v. Prior to taking up the welding job, the authorized person should ascertain the welder’s qualification.

vi. Provisions of OISD STD: 105 shall be followed for all Hot work permits.

vii. The area to be welded should be dry and brushed or wiped, free of any excess paint, grease, scale, rust or dirt.

viii. Preheating of 3” on each side of weld locations should be done to a temperature of 205 to 315 degree Celsius. Preheat temperature should be maintained during welding.

ix. Welded joint should be lowered after normal cooling only.

6.0 CASING LANDING PRACTICES:

Selection of proper casing landing procedure is important to avoid excessive stresses and unsafe tensile stresses at any time during the life of well. In arriving at the proper tension and landing procedure, consideration should be given to factors viz. well temperature, pressure, temperature developed due to cement hydration, mud temperature & change in temperature during producing operations.

As a general principle, casing should be landed in such a way that there is no tendency to buckle at any point above the freeze point and every effort should be made to prevent excessive washout. The normal design factors of burst, collapse & tension take care in handling the load changes that occur in normal wells, if pressure & temperature fluctuate widely, it is recommended to design casing with special attention on buckling.

Any of the following casing landing methods should be adopted:

a) After the cement has set, casing should be landed with exactly under same tension that was present when cement displacement was completed in the wells in which mud specific gravity does not exceed 1.5 gm/cc (12.5 ppg). Also ensure during design of casing that standard safety factors were considered and outer most casing have sufficient strength to withstand the landing loads.

b) Casing should be landed in such a manner that the casing at the top of cement is either in tension or completely balanced so far as tensile and compressive stresses are concerned.

c) Where excessive specific gravity of mud is used, casing should be landed with top of freeze point in tension. With the amount of tension at the freeze point being selected to prevent any tendency of the casing to buckle above the freeze point.

d) The approach suitable to well requirement to keep required tension or compression at the freeze point should be adopted. In practice, it may not be possible to anticipate all the changes.
of physical conditions that may occur during life of well. Landing casing in “as cemented” condition would be a reasonable approach.

7.0 PRECAUTIONS FOR HANDLING CORROSIVE ENVIRONMENT

Casing pipes can be damaged by internal and external corrosion. The condition of the casing can be determined by visual or optical instrument inspection. Casing caliper survey should be carried out to determine the condition of the inside surfaces which indicate the location and severity of corrosion.

The following methods and measures should be used to control corrosion of casing:

a) In case of external corrosion and stray electrical current surveys indicate that relatively high currents are entering the well, the following practices are recommended:
   • Good cementing practices should be adopted, including the use of centralizers, scratchers, and adequate amount of cement to keep corrosive fluids from contact with the outside of the casing.
   • Electrical insulation of flow lines from wells by the use of non-conducting flange assemblies to reduce or prevent electrical current from entering the well.
   • The use of highly alkaline mud or mud treated with a bactericide, as a completion fluid will help alleviate corrosion caused by sulfate reducing bacteria.

b. In case of internal corrosion, the following practices should be employed;
   • In flowing wells, packing the annulus with fresh water / low salinity alkaline mud / Inhibitors.
   • Wells having pumps like. Sucker rod and Electrical submersible pumps, the pump assembly should be placed as close to bottom to minimize the damage to the casing from corrosive fluids.
   • In pumping and gas lift wells; inhibitors introduced via the casing tubing annulus afford appreciable protection. Additionally in pumping wells, use of rod protectors, rotation of tubing and longer & slower pumping strokes, can also aid in extending the life of tubing.

C. When H₂S or CO₂ is present in the well fluids, casing of suitable grade should be selected keeping in view the effect of corrosion cracking.

8.0 TESTING OF CASING AND TUBING AFTER LOWERING

Casing string should be tested to ascertain the safe pressure, which can be applied to the casing during a kick and other critical operations.

The procedures for testing of casing after lowering depend on the type of casing setting depth and other relevant factors.

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8.1 Criteria of Testing
Following criteria should be taken into consideration to ascertain the test pressure:

i) To test the casing at maximum 80% of rated burst pressure of casing pipes or Working pressure of surface equipment or maximum anticipated surface pressure with safety factor whichever is less.

In case of combination casing string, the lowest burst rating of casing pipes should be considered.

8.2 Testing procedure

i) Conductor and Shallow Surface Casing:
- Shallow conductor casing is normally not tested except to ensure that it does not have any obvious large holes.
- Deep conductor and shallow surface casing are usually not tested or it may be tested at very low pressures to the order of 250 to 500 psi. based on requirement.

ii) Surface and Intermediate Casing:
The test pressures for the surface and intermediate casings depends on the pore pressures in the formations to be drilled below the casing, the anticipated kick pressure, and the burst rating of the casing.

iii) Production Casing:
- Production casing is normally designed to hold the pore pressure of the producing formation with a safety margin. The casing should be tested to this pressure.
- If production liner is set below intermediate casing then intermediate casing should also be tested along with liner. If the liner is tied back to the surface, the liner and the tie back string should also be subjected to similar test.

iv) Hermetical Testing of Well
a. Displace the mud in the well with water and wash the well till clear water starts coming out of the well.
b. Disconnect the rotary hose from tubing.
c. Make cementing unit connections with the tubing / drill pipe to facilitate the pumping of water for testing the casing hermetically.
d. Close the annulus valve on the tubing spool.
e. Start pumping water at a steady rate of 1 litre per second till the test pressure is reached (4-5 litres per cubic meter volume of the casing is required to be pumped for raising the pressure by 100 kg/cm²).
f. Hold this pressure for minimum 15 minutes.

v) Testing of Tubing

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The hydrostatic pressure testing of tubing may be undertaken prior to taking up packer setting etc. when integrity of tubing become essential. Test pressure should be kept at 80% of internal yield pressure based on 100% of wall thickness and minimum yield strength values. Successful pressure test is not positive proof of the lack of mill defects, since these may show up only after a number of cycles of pressure or temperature change.

9.0 RE USE OF CASING & TUBING

Casing pipes and tubing are being retrieved as when required depending upon the operational requirement. Its reuse calls for precautions as slight damage could reduce performance properties of pipes. Precautions to be observed during retrieval / recovery and repair are given below.

9.1 Precautions during recovery of Casing pipes

i. During recovery of casing, breakout tongs should be positioned close to the coupling between the tong and the coupling.

ii. Hammering the coupling to break the joint is not recommended. If tapping is required, use the flat face of the hammer. Tap lightly near the middle and completely around the coupling.

iii. Great care should be exercised to disengage all of the thread before lifting the casing out of the coupling. Do not jump casing out of the coupling.

iv. All threads should be cleaned and lubricated or should be coated with a material that will minimize corrosion. Clean protectors should be placed on the casing before it is laid down.

v. Before casing is stored or reused, pipe and thread should be inspected and defective joints marked for repair and re-gauging.

vi. When casing is being retrieved because of a casing failure, it is imperative for future prevention of such failures that a thorough metallurgical study be made. Every attempt should be made to retrieve the failed portion of the “as-failed” (same condition) for analysis and follow up.

vii. In case of stacking of casing pipe on derrick floor, pipes should be set on firm wooden platform and without the bottom thread protector.

viii. Depending on circumstances and needs, gauging of the threads may be considered along with the usual wall inspection to determine final performance properties.

ix. Utilization of the used casing or tubing should be based on experience and judgment with respect to well conditions and environment factors.

9.2 Procedure on reuse after Retrieval of casing & tubing

A) Damaged Pipe Body: -

Retrieved casing pipes should be inspected by visual, mechanical gauging and by NDT techniques e.g. electromagnetic, eddy current, ultrasonic and gamma ray. These inspection techniques should be adopted to segregate the repairable pipes keeping in view the following damages: -

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a. Outside and inside corrosion damage.
b. Inside surface wire line (longitudinal) damage
c. Outside transverse and longitudinal slip and tong cuts.
d. Inside surface drill pipe wear (casing only)
e. Transverse cracking (tubing only)
f. Inside surface sucker rod wear (tubing only)
g. Casing and tubing should be classified according to the loss of nominal wall thickness listed in Table 1

Following points should be considered while going through Table 1.

- Loss of nominal thickness of new pipe in the threaded portion and/or upset section, whether threaded and coupled external upset or integral joint, is not to be classified in accordance with Table 1.
- Loss of wall thickness in the heavier upset sections could be permitted to higher percentage depending on the intended service.
- Damage and/or wall reductions affecting the threaded ends of pipe require individual consideration depending on the anticipated service.

The colour code identification system used to denote the other defective conditions is provided in the Table 2. The colour coding should consist of a paint band of the appropriate colour approximately 2 inches wide around the body of the pipe approximately one foot from the box end.

B) Damaged Coupling:

- Connector joints of 18½ " & larger size O.D. Pipes shall be replaced and casing shall be subjected to hydraulic tests. Welding procedures shall be followed as per API standards.
- New coupling shall be replaced and pipes shall be subjected to hydraulic test as per API 5CT.

C) Repair of Casing Pipes:

Repair of casing pipes, should be carried out in such a way that specification of finished casing shall conform to API 5CT. Following points are to be included while carrying out the repair:

- Drifting of all pipes
- Thread inspection on each pipe
- Thickness gauging on each pipe
- Checking and straightness of each pipe
- Hydro testing on each pipe
- Reconditioned pipe must conform to API standard
- Marking of specification on each pipe
- Rust preventive coating to be applied

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9.3 Performance Properties of used casing

There is no standard method for calculating performance properties of used casing & tubing. Performance properties should be based on a constant OD. If external surface corrosion is evident, it must also be taken into account. Small pits or other localized metal loss may not be damaging depending on the application of the pipe, but this type of metal loss should be considered and evaluated.

Final rating of a length of pipe for further services requires consideration of the inside wall condition and remaining wall thickness to evaluate resistance of the body to collapse, burst and tension. Thread condition also require attention to evaluate resistance to leaks.

The re use of retrieved casing pipes after repair should be decided, depending upon the end use considering required performance properties vis a vis re-estimated performance properties of retrieved casing / tubing.

10.0 COMMON FIELD PRACTICE TO AVOID CASING & TUBING TROUBLE

i. Drill pipe being run inside casing should be equipped with suitable drill pipe protector to avoid damage to casing inner wall.

ii. Dropping a string, even a very short distance, may loosen the couplings at the bottom of the string.

iii. Leaky joints, under external or internal pressure are a common trouble and may be due to the following:

   • Improper thread compound
   • Improper tightening torque
   • Dirty threads
   • Improper cut threads
   • Couplings that have been dented by hammering
   • Excessive rerunning
   • Improper tightening torque
   • Dirty threads
   • Improper cut threads
Table: 1  “Classification and colour coding of used casing and tubing”

<table>
<thead>
<tr>
<th>Class</th>
<th>Colour Bond</th>
<th>Loss of nominal Wall thickness (Percent)</th>
<th>Remaining minimum wall thickness(Percent)</th>
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<tr>
<td>2</td>
<td>Yellow</td>
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<td>Blue</td>
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<td>5</td>
<td>Red</td>
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<td>Less than 50</td>
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Table: 2  “Colour Code Identification”

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<th>Conditions</th>
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<tr>
<td>Damaged field or pin end</td>
<td>One red paint band approximately 2 inches wide around the affected coupling or box end</td>
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<tr>
<td>Damaged coupling or box</td>
<td>One red paint band approximately 2 inches wide around the pipe adjacent to affected threads.</td>
</tr>
<tr>
<td>Pipe body will not pass</td>
<td>One green paint band approx. 2 inches wide at the point of drift restriction and adjacent to the colour band denoting body wall classification</td>
</tr>
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</table>

iv. Causes of casing troubles

a) Excessive torquing of casing to force it through tight places in the hole.

b) Pulling too hard on a string to make it free, may loosen the couplings at the top of the string. These should be re-tightened with tongs before finally setting the string.

c) Landing the casing with improper tension after cementing leads to failure of casing during subsequent rotary drilling inside the casing.

d) Drill pipe wear while drilling inside casing is particularly significant in deviated holes. Excess doglegs in deviated holes, or occasionally in straight holes where corrective measures are taken, result in concentrated bending of the casing that in turn result in excess internal wear.

e) Wire line cutting, by swabbing or cable tool drilling.

f) Buckling of casing in an enlarged & washed out un-cemented cavity due to release of tension in landing.

g) Application of high Torque on casing, especially during breaking out, cause a bending affect which lead to galling of threads.

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v. Causes of tubing troubles: -
   a. Improper selection of type / grade of tubing, especially of non-upset where upset tubing should be used.
   b. Excessive sucker rod breakage
   c. Use of worn-out and wrong types of handling equipment, spiders, tong’s die and pipe wrenches
   d. Replacement of worn couplings with Non API couplings.
   e. In case of fatigue failure at the last engaged thread, use of upset tubing over non-upset tubing reduces chances of failure.
   f. Tubing that has made multiple round trips in the hole, may have pins reduced in diameter due to successive yielding by repeated makeup. This condition may reduce joint strength, leak resistance, and in severe cases lead to abutment of pin ends near center of couplings

11.0 References:
   1. API 5C1- Recommended Practice for Care and Use of Casing and Tubing.
   2. API 5CT- Specification of Casing and Tubing
   3. API 5L- Specification of Line pipes
   4. SPE Bulletins
   5. API 5C 6- Welding Connections to Pipe
**ANNEXURE 2 a**

**CASING PIPE TALLY**

**COMPANY NAME:**

**RIG NO.:**

**WELL NO.:**

**DATE:**

**SUPPLY ORDER DETAIL:**

Casing Size: ___________ Wt: ___________ Grade: ___________ Thread: ___________

Float Shoe and Collar: Length: ___________ Position: ___________

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## Table 1: Casing Pipe and Tubing Data

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## Table 2: Additional Casing Pipe and Tubing Data

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ANNEXURE 2 b

CASING TALLY SUMMARY SHEET

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<th>SIZE</th>
<th>WEIGHT</th>
<th>GRADE</th>
<th>THREADS</th>
<th>S.O.NO.</th>
<th>SUPPLIER</th>
<th>NO. OF JOINTS</th>
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CASING RUN IN HOLE

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<th>THREADS</th>
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LENGTH OF CASING STRING ACCESSORIES RUN IN HOLE

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LEFT OVER CASING ON GROUND

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<th>WEIGHT</th>
<th>GRADE</th>
<th>CONNECTION</th>
<th>S.O.NO.</th>
<th>SUPPLIER</th>
<th>NO. OF JOINTS</th>
<th>TOTAL LENGTH</th>
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<th>TOTAL NO. OF JOINTS</th>
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<tr>
<td>E</td>
<td>BALANCE CASING LEFT ON GROUND</td>
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DETAIL OF CASING RETURNED:

(SIGNATURE OF INSTALLATION MANAGER / DIC)

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