BOILER DRUM LEVEL SELECTION & IMPLEMENTATION

Selection of Boiler's steam drum level set points for alarm and safe level trip interlock limit for failsafe operation of boiler to avoid pressure parts failure is primary responsibility of OEM & Design team for designing of adequate steam drum sizing at the time of low drum level & low-low drum level operation in boiler.

OEM vast experience and design knowledge failed to safeguard boiler from extreme damages when OEM try to save money and time in boiler commissioning by manipulating the steam drum level control and other essentially required control logics.

In Boiler, Steam Drum Sizing Selection mainly depend of level set points for alarm and safe level trip interlock, Water Level holding time to reach upto low limit in Boiler feed Pump / feed water supply stopped condition.

Boilers face Pressure Parts failure during commissioning, operation and just after maintenance due to low drum water level and starvation. It may be due to wrong control inputs, wrong operation, wrong interlocks design and human intervene in malfunctioning of safety interlocks.

SELECTION OF WATER LEVEL IN STEAM DRUM

1. General standard practice is to hold Normal Water Level (NWL) at centre line of steam drum +00 mm.
2. Height of Low-Low Water Level from Bottom of Steam Drum inside diameter (ID) need to be enough to increase water holding time at rated steam mass flow between NWL to LLWL & to avoid downcomer steam blanketing.
3. The Trip Level i.e. Low-Low Water Level (LLWL) and High-High Water Level (HHWL) is usually depend on steam drum diameter and by the highest point at which downcomers are entering in the steam drum / top of steam drum cyclone.
4. **For Example**: Steam Drum diameter upto 1070 mm the Trip LLWL level is taken as -200 mm and for steam drum diameter more than 1070 mm the Trip LLWL level is -250 mm.
5. Local Field Gauge Glass visibility scale, Drum level transmitter tapping points and matching of drum level transmitters scaling with local field installed Gauge glass need to check and verify before start of boiler operation.
6. Minimum 50 mm visibility in required in local field gauge glass at Low-Low Drum Level (LLWL) for safe operation and for tripping on level transmitters also.

EXAMPLE ON STEAM DRUM SIZING w.r.t. DRUM LEVEL TRIP LIMITS

Customer Requirement:

Steam Drum has a minimum Two Minutes Storage Capacity between Normal Water Level (NWL) and Low-Low Water Level (LLWL) at boiler rated steam mass flow.

OEM Design & Consideration:

1. To fulfill the customer requirement of minimum Two Minutes storage capacity at boiler rated steam mass flow, Steam Drum Length is required 14 meter as per general engineering calculation and client trip level value.

2. OEM wants to reduce costing, hence Steam Drum Supplied Length is restricted to 11 meter for cost optimization by manipulating the steam drum water low level alarm and low-low level trip interlock limit.

3. A Rough Explanation to achieve customer requirements and OEM cost optimization on account of boiler safety and life.

S.N.	Parameters	Customer Requirements	OEM Cost Optimization
1	Steam Drum Diameter (ID)	Same	Same
2	Steam Drum Thickness	Same	Same
3	Centre Line to NWL	Same i.e. Zero	Same i.e. Zero
4	Storage Capacity at boiler rated steam mass flow in Minutes from NWL to LLWL	Same i.e. 02 Minutes	Same i.e. 02 Minutes
5	High Water Level (HWL) Alarm	Same	Same
6	High-High Water Level (HHWL) Alarm	Same	Same
7	Low Water Level (LWL) Alarm	180 mm	310 mm
8	Low-Low Water Level (LLWL) Alarm	260 mm	390 mm
9	**Steam Drum Length in Meter**	**14 Meter**	**11 Meter**

IMPACT OF COST OPTIMIZATION ON WATER LEVEL IN STEAM DRUM

Presently to reduce cost on shake name of value engineering, the OEM & Designer are trying to manipulate the steam drum level be changing the alarm and safe trip interlock limit.

1. Normal Water Level (NWL) operation points changed from centre line of drum to higher side by +50 mm to +75 mm which increase water carry over, higher loading on cyclone resulting the poor saturated steam quality and contamination deposition in steam path.
2. Higher Water Level (HWL) operation points changed w.r.t. NWL in drum to higher side which leaves impact on controlling of water level in steam drum.
3. Lower Water Level (LWL) operation points changed w.r.t. NWL in drum to lower side which leaves impact on safe water holding capacity and less time to recover level in steam drum.

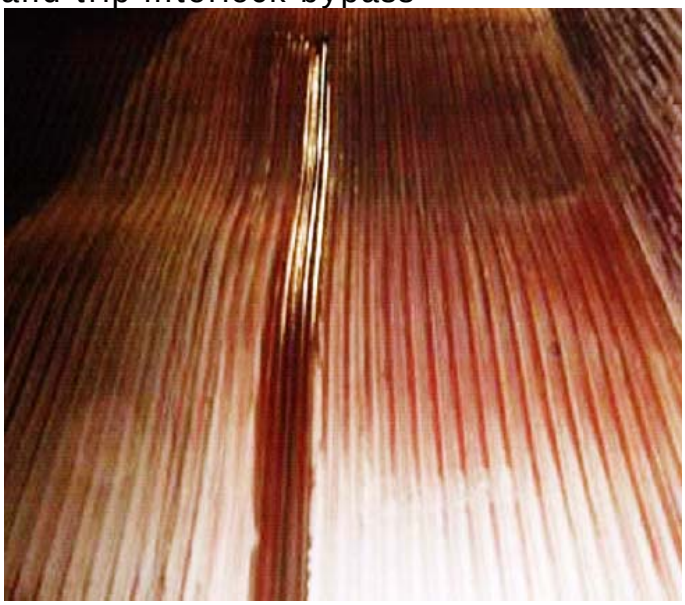
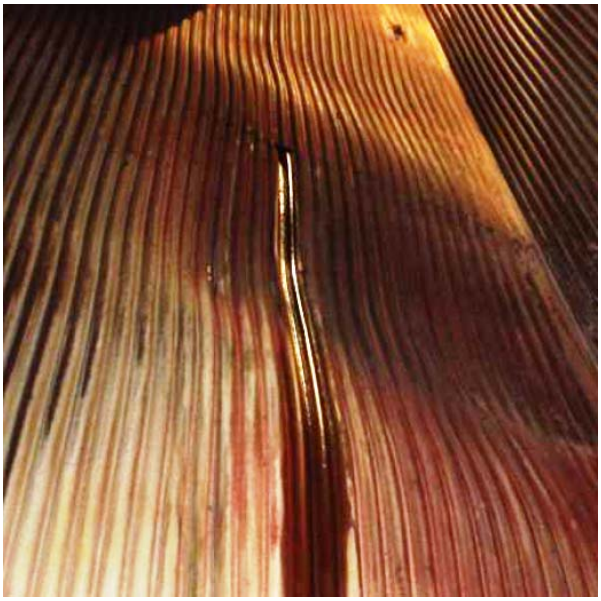
4. Water Holding time from NWL to LWL in minute = (Total Water Volume in m3 at NWL - Total water volume in m3 at LWL) / Boiler Evaporation Rate in m3/minute
5. Water Holding time from NWL to LLWL in minute = (Total Water Volume in m3 at NWL - Total water volume in m3 at LLWL) / Boiler Evaporation Rate in m3/minute
6. Boiler Evaporation Rate in m3/minute = Boiler Steaming Capacity x Specific Volume of Water at Drum Operating Pressure
7. Consider the height difference in-between Top of downcomer to LWL / LLWL for safe boiler operation and minimize the risk of starvation in boiler pressure parts.

IMPACT OF OPERATION & MAINTENANCE ON WATER LEVEL IN STEAM DRUM

1. Level Centre line matching of Local Field Gauge Glass and Level Transmitters i.e. level indication on 100%, 75%, 50% and 25% in both gauge and transmitter should be same
2. Calibration, Dumping in transmitter, Density correction factor, Level Scaling in Level transmitter and use of Compensated Drum Level for control with average transmitter level value selection should be recorded and maintained on regular intervals
3. Correct Erection & Installation of Level sensing lines and condensate pots
4. Local Field Gauge Glass flushing and warm-up during initial start of boiler and later on regular intervals

TUBES FAILURES BY DRUM LEVEL ERROR & INTERLOCK BYPASS

1. Pressure Parts Failure due to wrong value selection in level control logic and trip interlock bypass

2. Pressure Parts Failure due to failure of drum level control

M/s Unite Energy Corporation LLP is keen to provide the Boiler Spares, Sales & Services, Retrofit & Site Repairs of Boiler & Auxiliaries, Performance Evaluation, Shop & Site Fabrication, Erection & Commissioning, Design Modification & Feasibility Study, Consultancy & troubleshooting support to mitigate the irregularities in the plant, minimize breakdown & downtime and improvise design & system performance to improve the overall plant's health and performance.

Regards

Pramesh Kumar Jain
Chief Executive- Technical
Mobile: **+91 9868499319**
Email: **pramesh.uniteenergy@gmail.com**

Unite Energy Corporation LLP,
Ghaziabad, U.P., INDIA