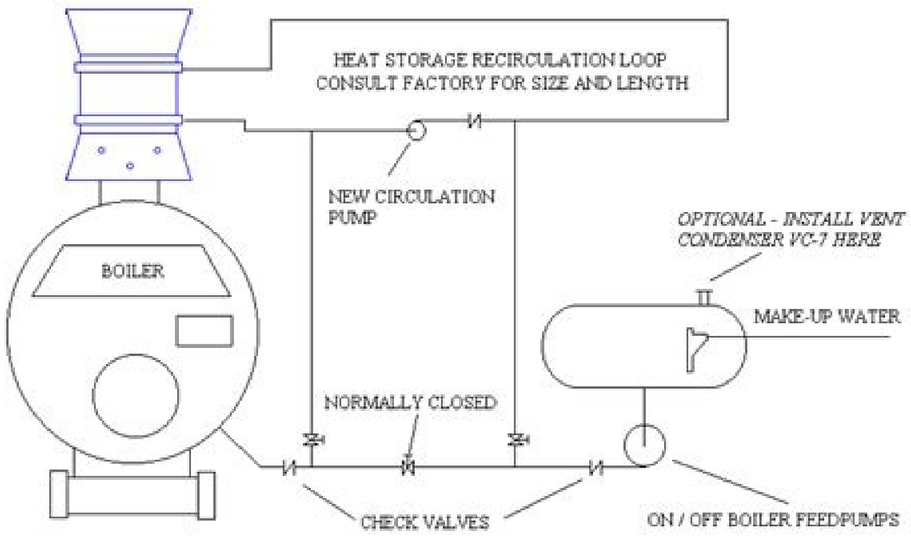
Boiler feed water quality standards pdf



January/February 2011

Web Exclusive

Boiler feedwater control

Editorial note: Following the positive response InTech *and author Jerry Gilman received when his "Boiler drum level control" article ran in the magazine in 2010 (www.isa.org/intech/20100806), Gilman has returned with a second boiler control contribution.*

By G. F. (Jerry) Gilman

Some boilers utilize a reasonably steady load so only drum level control from single element drum level measurement is possible. Single element control is used on boilers during startup or low load regardless of capacity or rapid load swings. Single element control has often been unsatisfactory because some of the newer boiler designs have minimum water storage compared to the steaming rate of the boiler. A majority of the larger sized units and those subject to rapidly fluctuating loads require different methods of control. A two element system controlling the feedwater control valve from the steam flow signal and resetting the drum level signal is able to handle some of the less difficult systems. Larger units with small storage capacity related to throughput, and units experiencing severe, rapid load swings, usually require three element control, whereby water flow is matched with steam flow and reset from the drum level signal.

Single element feedwater level control

Single element drum level control measures drum level only. This is a simple feedback control loop (Figure 1).

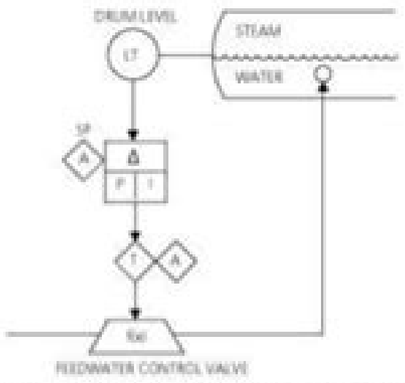


Figure 1: Single element feedwater level control

The mass of the water flow and the steam flow must be regulated so mass water flow equals the mass steam flow to maintain drum level. The feedwater control regulates the mass water flow to the boiler. The effects of

Boiler Water Quality Recommendations at Increasing Temperatures

Boiler Steam Pressure (PSI)	Maximum TDS (ppm)	Maximum Alkalinity (ppm)	Maximum Hardness (ppm)
Low – 300	3500	700	20
301 – 450	3000	600	<5
451 – 600	2500	500	<5
601 – 750	2000	400	<5
751 – 900	1500	300	<5
901 – 1000	1250	250	<5
1001 – 1500	1000	200	<5
1501 – 2000	750	150	<5
2001 – 3000	150	100	<5

Proceedings of ASME Turbo Expo 2001
June 4-7, 2001 New Orleans

Paper No: 2001-GT-0526

INLET FOGGING OF GAS TURBINE ENGINES DETAILED CLIMATIC ANALYSIS OF GAS TURBINE EVAPORATIVE COOLING POTENTIAL IN THE USA

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ABSTRACT

Inlet fogging of gas turbine engines has attained considerable popularity due to the ease of installation and the relatively low first cost compared to other inlet cooling methods. With increasing demand for power and with shortages envisioned especially during the peak load times during the summers, there is a need to boost gas turbine power. There is a sizable evaporative cooling potential throughout the world when the climatic data is evaluated based on an analysis of *coincident wet bulb and dry bulb information*. This data is not readily available to plant users. In this paper, a detailed climatic analysis is made of 122 locations in the US to provide the hours of cooling that can be obtained by direct evaporative cooling. This data will allow gas turbine operators to easily make an assessment of the economics of evaporative cooling. The paper also covers an introduction to direct evaporative cooling and the methodology and data analysis used to derive the cooling potential in different regions of the US. Simulation runs have been made for gas turbine simple cycles using a reference plant based on a GE Frame 7111EA gas turbine at the 122 locations studied in the US to provide a feel for the sensitivity of operation with inlet fogging.

NOMENCLATURE

ECDH	Equivalent Cooling Degree Hours
GPM	Gallons/minute
DB	Dry Bulb Temp
WB	Wet Bulb Temp
WG	Water Gauge

1. INTRODUCTION

Gas Turbine output is a strong function of the ambient air temperature with power output dropping by 0.3-0.5 % for every 1°F rise in ambient temperature. On several heavy frame gas turbines, power output drops of around 20% can be experienced when ambients reach 95°F (35°C), coupled with a heat rate increase of about 5%. Aeroderivative gas turbines exhibit even a greater sensitivity to ambient conditions. Figure 1 derived by examining several turbines provides a representation of the power boost capability for different types of gas turbines. This was derived using GTPRO[1] software over a range of turbines. This loss in output presents a significant problem to utilities, cogenerators and IPPs when electric demands are high during the hot summer months. In the petrochemical and process industries, the reduction in output of mechanical drive gas turbines often curtails plant output. For example, at some LNG plants, production may have to be curtailed during the hot afternoons when the refrigeration capacity is limited by gas turbine driver power. One way to counter this drop is to cool the inlet air. While there are several cooling technologies available, fogging has seen large-scale application because of the advantage of low first cost when compared to other techniques including media evaporative cooling and refrigeration technologies[2].

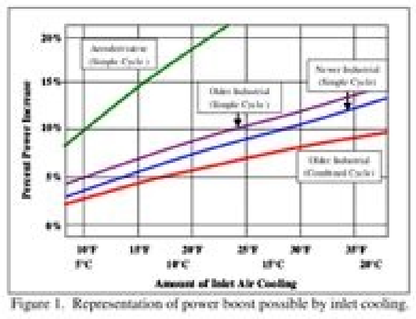

Figure 1. Representation of power boost possible by inlet cooling.

[1] Program by Thermoflow Inc.
[2] Cost ratios are about 5:1 but can vary based on project specifics.

Asme boiler feed water quality standards pdf. Is standard for boiler water quality. Boiler feed water quality standards pdf. What should be the tds of boiler feed water. Boiler feed water requirements. Boiler feed water quality standards asme.

↼ Home • Knowledge • Boiler Operation ↓ Codes and Standards • Operating Mode • Boiler Feed Water • Boiler Water Applicable Codes and Standards: harmonised European standards: EN 12952-12 / Water-tube boilers – Requirements for boiler feed water and boiler water quality EN 12953-10 / Shell boilers – Requirements for boiler feed water and boiler water quality national codes and standards: BS 2486 / Recommendations for Treatment of Water for Steam Boilers and Water Heaters (United Kingdom, obsolete) TRD 611 / Feed Water and Boiler Water of Group IV Steam Generators (Germany, obsolete) TRD 612 / Water for Group II to IV Hot Water Generators(Germany, obsolete) ... further codes and standards issued by various organisations: VGB-S-010-T-00 / Feed Water, Boiler Water and Steam Quality for Power Plants / Industrial Plants (formerly VGB-R 450 L) VGB-M 410 N / Quality Requirements for District Heating Water VdTÜV MB TECH 1453 / Guidelines for Feed Water, Boiler Water and Steam of Steam Generators (obsolete) VdTÜV MB TECH 1466 or AGFW FW 510 / Requirements for the Recirculating Water of Industrial and District Heating Plants ... operating instructions and warranty conditions of boiler and component manufacturers All of the above documents contain concise instructions regarding the water chemistry of the boiler feed water and boiler water of steam boilers and hot water boilers, e.g. limit values for the →electrical conductivity or the pH-value. The aforementioned harmonised European standards can be assumed to be commonly accepted codes of practice conforming to any applicable EU directives. The stated goal of these standards is to uphold minimum requirements for a safe boiler operation. The legal requirements of conformity with any applicable EU directives result from the implentation of those EU directives into national law. The placing onto the market of steam boilers and warm water boilers is governed by the EC directive 97/23/EC (pressure equipment directive), and has in Germany been implemented as the Product Safety Act (ProdSG). The operation and surveillance of steam boilers and warm water boilers are governed by the EC directive 2009/104/EC (minimum safety and health requirements for the use of work equipment by workers at work), which in Germany has been implemented as the Ordinance on Industrial Safety and Health (BetrSichV). The aforementioned national codes and standards are no longer being updated. Accordingly, with ongoing technological advancement, it is questionable to which extend they can still be considered to be commonly accepted codes of practice. However, these national codes and standards are sometimes still cited in operating instructions, tender specifications, and delivery contracts, thus affecting warranty claims and contractual obligations. The application of the aforementioned further codes and standards issued by various organisations is optional, and can for example be part of a contractual agreement. The goal in these cases is to operate a steam boiler plant or hot water boiler plant in an economically sensible manner, rather than just fullfilling basic safety requirements. For example, the VGB standard VGB-S-010-T-00 (formerly VGB guideline VGB-R 450 L) is commonly applied for steam turbine plants across Europe, especially in German-speaking countries. ↑ top of page Definition of the Operating Mode: In the by now obsolete German code ↑TRD 611, the boiler operating mode used to be defined as either "high TDS", "low TDS", or "no TDS", based upon the →electrical conductivity of the boiler feed water. These terms are still widely used within the field of →boiler feed water treatment. Similar distinctions are also still made in the latest harmonised European standards, however without defining any specific terms. By taking into account the latest codes and standards, the boiler operating mode can be defined as follows, based upon the →electrical conductivity of the boiler feed water: "high TDS": direct electrical conductivity > 30 µS/cm "low TDS": direct electrical conductivity ≤ 30 µS/cm "no TDS": cation conductivity < 0.2 µS/cm Basically, if the make-up water is being treated by a →softening plant only, "high TDS" operation can be assumed, while "low TDS" operation can be assumed in case of treatment by →reverse osmosis. "No TDS" operation requires demineralised water, meaning polishing of the make-up water – and possibly also of the condensate – with a →mixed bed exchanger, or with an →EDI plant either located upstream of the mixed bed exchanger, or used instead of the mixed bed exchanger. The boiler operating mode is not chosen arbitrarily for a given application. Instead, it is determined based upon the process conditions and requirements, and possibly also the source and quality of the available raw water. For example, in case of steam boiler equipped with a superheater for process steam production, "low TDS" operating mode is often required in order to be able to operate the steam boiler plant with an economic blow-down rate. In case of "high TDS" operation, the required boiler water blow-down rate is approximately 3% ... 10%, while it is approximately 1% ... 2% in case of "low TDS" operation, and ≤ 0.5% ... 1% in case of "no TDS" operation. ↑ top of page Requirements for the Boiler Feed Water of Steam Boilers: design – shell boiler water-tube, circulating water-tube, once-through operating mode – "high TDS" "low TDS" "no TDS" "low TDS" "no TDS" conditioning – phosphate / sulphite AVT / phosphate OT AVT OT operating pressure bar ≤ 20 ≤ 40 ≤ 20 ≤ 40 ≤ 40 > 40 > 40 > 40 > 40 MPa ≤ 2 ≤ 4 ≤ 2 ≤ 4 ≤ 4 > 4 > 4 > 4 > 4 > 4 > 4 direct conductivity µS/cm > 30 ≤ 30 4.3 ... 8.6 ≤ 30 4.3 ... 8.6 1.7 ... 4.3 4.3 ... 8.6 0.7 ... 2.8 cation conductivity µS/cm – – – – < 0.2 – < 0.2 < 0.1 < 0.2 < 0.1 pH-value – 9.2 ... 9.5 9.2 ... 9.5 9.2 ... 9.5 9.2 ... 9.5 9.2 ... 9.5 9.2 ... 9.5 9.2 ... 9.5 8.5 ... 9.2 9.2 ... 9.5 8.4 ... 9.0 hardness mmol/L < 0.01 < 0.01 < 0.01 < 0.01 – < 0.005 – – – – °dH < 0.05 < 0.05 < 0.05 < 0.05 – < 0.03 – – – – mg/L CaCO3 < 1 < 1 < 1 < 1 – < 0.5 – – – – iron mg/L Fe < 0.3 < 0.1 < 0.3 < 0.1 < 0.02 < 0.02 < 0.02 < 0.02 < 0.01 < 0.01 silicic acid mg/L SiO2 – – – – < 0.02 – < 0.02 < 0.02 < 0.02 < 0.02 < 0.02 oxygen mg/L O2 < 0.02 * < 0.02 < 0.02 < 0.02 < 0.02 < 0.02 < 0.02 0.03 ... 0.1 < 0.1 0.03 ... 0.25 oil, grease mg/L < 1.0 < 0.5 < 1.0 < 0.5 < 0.5 < 0.5 < 0.5 < 0.5 n.d. n.d. TOC mg/L C < 2.5 < 2.5 < 0.5 < 0.5 < 0.1 < 0.2 < 0.1 < 0.1 < 0.1 < 0.1 * According to EN 12953-10, an oxygen concentration of < 0.05 mg/L is allowed in the boiler feed water of shell boilers with an operating pressure ≤ 20 bar, thus differing from the above requirements. The above requirements are supposed for initial information only, and are neither comprehensive, nor neccessarily in conformance with the applicable codes and standards. For actual steam boiler operation, the applicable codes and standards in their latest issue, the operating instructions of the respective boiler manufacturer, and any recommendations by the notified body responsible for surveillance of the boiler system shall take precedence. The above requirements are not valid for hot water boilers and pure steam generators. ↑ top of page Requirements for the Boiler Water of Steam Boilers: design – shell boiler water-tube, circulating operating mode – "high TDS" "low TDS" "no TDS" "low TDS" "no TDS" conditioning – phosphate / Sulphite AVT / phosphate OT operating pressure bar ≤ 20 ≤ 40 ≤ 20 ≤ 40 ≤ 40 > 40 > 40 > 40 > 40 MPa ≤ 2 ≤ 4 ≤ 2 ≤ 4 ≤ 4 > 4 > 4 > 4 > 4 direct conductivity µS/cm ≤ 6000 ≤ 3000 ... 6000 ≤ 1500 ≤ 1500 < 100 ≤ 250 ... 1500 < 50 – cation conductivity µS/cm – – – – – – – < 5 pH-value – 10.5 ... 12 10.5 ... 11.8 10 ... 11 10 ... 11 9.5 ... 10.5 9.5 ... 10.5 9.4 ... 10.2 8.5 ... 9.2 p-alkalinity mmol/L 1 ... 15 1 ... 10 0.1 ... 1 0.1 ... 1 – 0.1 ... 0.3 – – mg/L CaCO3 50 ... 750 50 ... 500 10 ... 100 5 ... 50 – 5 ... 15 – – silicic acid mg/L SiO2 ≤ 100 ... 160 ≤ 50 ... 130 ≤ 80 ... 130 ≤ 30 ... 80 < 15 ≤ 2 ... 30 < 2 ... 10 < 2 ... 10 phosphate mg/L PO4 ≤ 20 ≤ 15 ≤ 10 ≤ 10 < 6 < 6 – sulphite mg/L SO3 6 ... 12 6 ... 12 6 ... 12 6 ... 12 – – – – The above requirements are supposed for initial information only, and are neither comprehensive, nor neccessarily in conformance with the applicable codes and standards. For actual steam boiler operation, the applicable codes and standards in their latest issue, the operating instructions of the respective boiler manufacturer, and any recommendations by the notified body responsible for surveillance of the boiler system shall take precedence. The above requirements are not valid for hot water boilers and pure steam generators. ↑ top of page 2018-05-05 • water treatment made in Germany • Company Information • Privacy Water absorbs more heat for a given temperature rise than any other common inorganic substance. It expands 1600 times as it evaporates to form steam at atmospheric pressure. The steam is capable of carrying large quantities of heat. These unique properties of water make it an ideal raw material for heating and power generating processes. All natural waters contain varying amounts of dissolved and suspended matter and dissolved gases the amount of minerals dissolved in water varies from 30 g/l in sea water to anything from 0.005 to 1500 mg/l in fresh water supplies. Since water impurities cause boiler problems, careful consideration must be given to the quality of the water used for generating steam. The composition of boiler feed water must be such that the impurities in it can be concentrated a reasonable number of times inside the boiler, without exceeding the tolerance limits of the particular boiler design. If the feed water does not meet these requirements it must be pretreated to remove impurities. The impurities need not be completely removed in all cases, however, since chemical treatment inside the boiler can effectively and economically counteract them. Feed-water purity is a matter both of quantity of impurities and nature of impurities: some impurities such as hardness, iron and silica are of more concern, for example, than sodium salts. The purity requirements for any feed-water depend on how much feed water is used as well as what the particular boiler design (pressure, heat transfer rate, etc.) can tolerate. Feed-water purity requirements therefore can vary widely. A low-pressure fire-tube boiler can usually tolerate high feed-water hardness with proper treatment while virtually all impurities must be removed from water used in some modern, high-pressure boilers. Only relatively wide ranges can be given as to maximum levels of alkalis, salt, silica, phosphates etc, in relation to working pressure. The actual maximum levels must be obtained fro the boiler manufacturer, who will base them on the characteristics of the boiler in question. The following tables are extracts of recommended levels from APAVE (Association of electrical and steam unit owners), up to pressures of 100 bar for medium steaming rates and for volumes of water in the chambers sufficient to properly control the blow down rates, and from ABMA (American Boiler Manufacturers Association) in its standard guarantee of steam purity. Working Pressure (Bar) 0 - 20.7 20.8 - 31.0 31.1 - 41.4 41.5 - 51.7 51.8 - 62.1 62.2 - 68.9 69.0 - 103.4 103.5 - 137.9 Dissolved oxygen (measured before oxygen scavenger addition) 0.04 0.04 0.007 0.007 0.007 0.007 0.007 0.007 0.007 Total Iron mg/l 0.1 0.05 0.03 0.025 0.02 0.02 0.01 0.01 Total copper 0.05 0.025 0.02 0.02 0.015 0.015 0.01 0.01 Total hardness (CaCO3) 0.3 0.3 0.2 0.2 0.1 0.05 not detectable Non volatile TOC 1 1 0.5 0.5 0.5 0.2 0.2 0.2 Oily matter 1 1 0.5 0.5 0.5 0.2 0.2 0.2 pH at 25 7.5 - 10.0 7.5 - 10.0 7.5 - 10.0 7.5 - 10.0 7.5 - 10.0 8.5 - 9.5 9.0 - 9.6 9.0 - 9.6 Silica mg/l 150 90 40 30 20 8 2 1 Total alkalinity CaCO3 350 300 250 200 150 100 not specified Free hydroxide alkalinity CaCO3 not specified not detectable Specific conductance at 25 without neutralization µS/cm 3500 3000 2500 2000 1500 1000 150 100 Working Pressure (Bar) 0 - 15 15 - 25 25 - 35 35 - 45 40 - 60 60 - 75 75 - 100 Dissolved oxygen (measured before oxygen scavenger addition) mg/l 0.02 (Physical removal of dissolved oxygen) Total hardness French degrees 0.5 0.3 0.2 0.1 0.05 0.05 0.05 Oily matter mg/l absence 0.05 0.05 0.05 pH > 8.5 Total Iron mg/l not specified 0.05 0.05 0.03 Total copper not specified 0.03 0.03 0.01 M alkalinity French degrees 100 80 60 40 15 10 5 P alkalinity 0.07 M 0.07 M 0.07 M 0.07 M > 0.5 M > 0.5 M > 0.5 M SiO2 mg/l 200 150 90 40 15 10 5 TDS 4000 3000 2000 1500 500 300 100 Phosphates 30 to 100 31 to 100 20 to 80 21 to 80 10 to 60 10 to 40 5 to 20 pH 10.5 to 12 10 to 11 Make up water Softened or softened and carbonate free Demineralized Find information about the main problems occurring in boilers: scaling, foaming and priming, and corrosion. Check also our general web page about boiler feed water. Click here for more information about boiler water treatment, in particular through deaeration (deaerating heaters or membrane contractors) References ‘Water treatment handbook’ Vol. 1-2, Degremont, 1991 ‘Industrial water conditioning’, BeltsDearborn, 1991

Treat all boiler feed water as though it is hard water. Use chemical inhibitors on every job. Flush old and new systems with fresh clean water before commissioning a new boiler. Use magnetic dirt separators on systems containing large amounts of iron. Use Dirt Separators to remove debris from system water. Where possible, treat boiler feed ... 20/10/2015 · Japanese Standards Association (JSA) List your products ... 81 335-862014 Business Type: Service. Supplier Website JSA - JIS B 8223 Water conditioning for boiler feed water and boiler water active, Most Current Buy Now. Details. History. References ... This document provides parameters and methods for water quality stability ... Feedwater Analysis Includes: pH. Total Hardness. TDS. M. and P. Alkalinity. Phosphate. Chloride. Industrial Boiler water testing is important to understand the scaling or corrosion potential of the water, to see whether sufficient chemical inhibitor is present and whether there is risk of carryover which can contaminate product if you use live ... Recommended Water Quality For Firetube Boilers. Feed Water. pH: 8.5–9.2 – Should be alkaline at all times. Hardness: Zero ppm: ... as general guidance only and does not absolve the boiler owner from the responsibility of determining and maintaining water standards appropriate to the specific local water chemistry and specific boiler use. About; water specification for low to medium pressure boiler plays vital role in energy conservation,water pramaeters decides fouling, scaling and energy loss.. ... Boiler Feed water Specification:-Boiler Pressure: 0-20 Barg: 21 o 39 Barg: 40 – 59 Barg: Total hardness as CaCo3, mg/ltr, Max: 10: 1.5: pH value: 8.5-9.5: 1/1/2001 · Boiler Water Limits and Achievable Steam Purity for Water ... 01/01/1995. Historical Editions: ABMA-Boiler 402, ABMA-Boiler 400 ABMA-Boiler 402 Boiler Water Quality Requirements and Associated Steam Quality for ICI Boilers. standard by American Boiler ... Codes & Standards; Boiler Efficiency Calculator; Boiler Maintenance Schedule; Then, the presence of impurities in the boiler water must be properly controlled with the blowdown rates. Harmonized standards are widely used for the requirements for boiler feed water and boiler water quality. The stated goal of these standards is to uphold minimum requirements for a safe boiler operation. — 4/4/2022 · April 4, 2022. Ryan Waldron. It’s important to understand how your boiler feedwater system functions, especially when trying to extend the useful life of your equipment. Low-quality boiler feedwater contains impurities and gases that can damage the whole system. This will lead to a reduction in efficiency and, even worse, boiler leaks or ...

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