CHPQA PROGRAMME

Metering Requirements & Data Quality

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Introduction to Metering Requirements

- Our audits & validations have shown that many RPs are still unclear about CHPQA metering & uncertainty requirements.
- Therefore, a brief review of the requirements is given here.
- The metering uncertainty requirements given here are for schemes > 2MWe.

Metering Requirements

- All Fuel Inputs, Generated Power Outputs & Useful Heat Outputs associated with CHPQA schemes must be monitored.
- In all cases, monitoring of the energy streams must be accomplished using appropriate **metering.**
- Although, there are some cases where indirect metering/monitoring is acceptable.
- Allowable uncertainties for each case, are given in the appropriate Guidance Note.

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CHPQA Metering Requirements

• Fuel Inputs, kWh	±2.0% of reading
• Energy inputs as steam or hot water, kWh	As for steam or hot water as appropriate (see below)
• Heat metering, of hot water, thermal fluid or other liquid heat circulating loops, kWh,	Metering to BS EN 1434-1:2007, metrological Class 3 (typically 4.5% of reading) with concessions for Schemes with TPC <2MWe), see GN16.15 – 16.16;
• Heat metering, of steam flows, kWh	±2.0% of full scale on ±3.0% of reading
• Electric power, kWh	Metering to applicable BS and Class dependant on rating, see GN15.7
• Indirect measurement or calculation of energy input or output, kWh	±2.0% of value, except for heat outputs from Schemes with TPC <2MWe where ±5.0% of value applies.

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Do all schemes have to meter their heat output ?

- No!
- Simple RE schemes below 2MWe using circulating hot water are **not** required to meter heat outputs, if **no** heat rejection facility is installed .
  - Instead can use H:P ratio and the metered power output to determine heat.
- Indirect Methods, as agreed with CHPQA, still apply for monitoring Direct use of Exhaust Gases (see GN 21.2 & 21.3).

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Heat Metering Options – Hot Water

- Stand alone commercially available heat meters (fully integrated heat meters) to BS EN1434:2007
- Heat metering by computation within control systems, ie BMS:
  - using measured flow and return temperatures, and measured flow rate
- An alternative for Schemes below 2MWe with a dump facility:
  - Use two matched pairs of t/c and the design H:P

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Uncertainties and Uncertainty Adjustment Factors

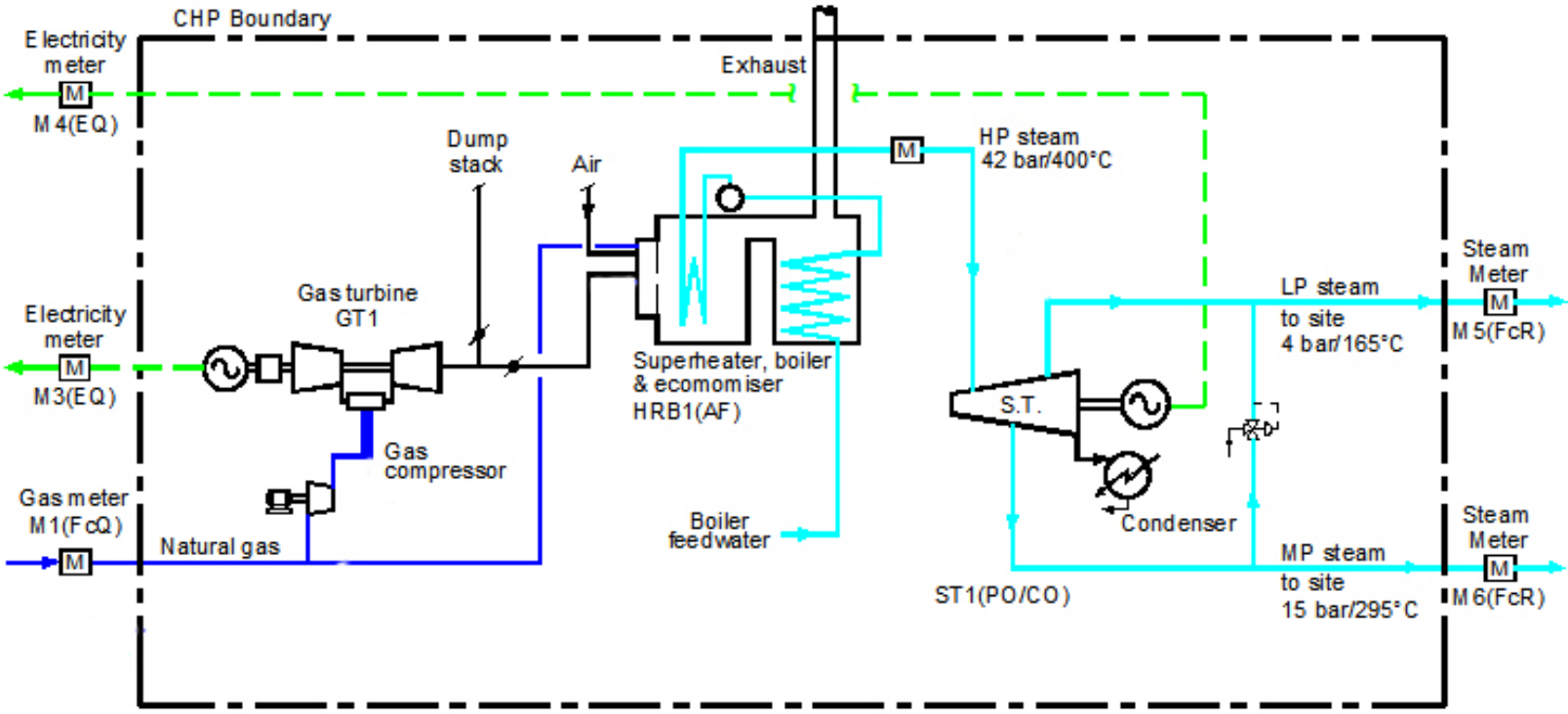
- Overall Uncertainties for Individual Fuel & Heat Metering Devices, together with Uncertainty Budgets, are calculated using GN17, which offers default values for all 5 elements of meter uncertainty.

- Overall Uncertainties for **Indirect** Measurement of Fuel or Heat Flows are computed using GN 18, as are those that involve **Subtraction** of metered streams.

- Excess Uncertainty (**U_{xs}**) and Uncertainty Adjustment Factors for Individual Fuel, Electricity & Heat Metering Devices (FOI, FOP & FOH) are calculated using GN 19.

- Uncertainty adjustments only applied to schemes >2MWe.

Case Study



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CASE STUDY

- The uncertainty of the metering devices shown in Fig 3 are now considered in turn:

Fuel Metering

- Uncertainty of the Transco Gas meter (M1) is accepted as ±1.5%, & it meets the ±2% best practice requirement.
- Excess Uncertainty of M1= 0; & Uncertainty Adjustment FOI =1.000.

Generated Power Metering

- Generated Power meters (M3 & M4) are stamped as Class 1.0. The GT & ST specification documents ratings of 9.0 & 2.5 MWe, respectively.
- Therefore, both meters meet best practice requirements of GN15.7.
- Excess Uncertainty for both = 0; & Overall FOP =1.000.

Heat Metering

- Overall Uncertainties of Steam meters (M5 & M6) are computed individually from GN17 as 2.30% & 3.00% respectively.
- best practice requirement is 3.0% for each meter
- Excess Uncertainty and Overall Uncertainty Adjustment Factor for the combination of meters (FOH) is determined from GN 19.
- Excess Uncertainty of = 0; & Uncertainty Adjustment FOH =1.000

GN17 Uncertainty Assessment

Example GN17-1 – Calculation of Flow Meter Uncertainty(Work Sheet)

Flow Meter	**Tag Number:** M9(FQ)			Metered fluid:	**MP Steam**
Line conditions	Pressure, bar(gauge) 10			Temperature,°C	200

Meter type – Primary device (tick appropriate box)	Orifice Plate ✓	Venturi	Averaging pitot	"V-cone"	"Gilflow"
	Vortex shedding	Coriolis	Turbine	Other (please specify)	

Table of Uncertainties	Ref GN	**Effective Uncertainty Ue**			**Ue^2**
		Default value of **Ue, %**	Claimed value of **Ue, %**	Ref to source data attached	
Primary meter uncertainty	17.34	1.0	**1.0**	default	**1.000**
Transmitter and computations	17.35	1.0	1.0	default	**1.000**
Fluctuations in fluid properties	17.36 to 17.44	Table GN17-2: **3.0** Uncompensated SH Steam			**9.0000**
Time elapsed since last calibration (transmitter to output value)	17.45	Table GN17-3: **0.0** 18-months	Use default value		**0.0000**
Time elapsed since last calibration or inspection of primary flow device	17.46	Table GN17-4: **3.0** 6-years	Use default value		**9.0000**
Sum of all $Ue^2 = U^2$				**Total**	20.000
Overall Uncertainty, U =Square root U^2					**4.47%**
Acceptable Uncertainty for "Best Practice", UBP (GN17.12-GN17.14)					**3.00%**
Excess Uncertainty, Ux = U minus UBP (Ux = 0 if U <UBP)					**1.47%**

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Uncertainty Adjustment Factors

Meter or Calc. No.	Description of Output (e.g. MP steam to site)	Annual Heat Output (From Form F4, Section 6c)	Fraction of QHO **F**	Acceptable Uncertainty for Best Practice U_{BP}	Actual Uncertainty **U**	Excess Uncertainty $U_x=U-U_{BP}$ (if $U<U_{BP}$, $U_x=0.00$)	Individual Adjustment Factor $F_1=1-(U_x/100)$	Weighed Adjustment Factor $F_W=FxF_1$
		MWh	(4 decimal places)	% (2 decimal places			(4 decimal places)	
M9	Steam	10000	0.8333	3.00	4.47	1.47	0.9853	0.8211
M10	HTHW	2000	0.0988	3	2	0.00	1.0000	0.0988
			0.0000			0.00	1.0000	0.0000
			0.0000			0.00	1.0000	0.0000
	Total	12000	0.9322			**Overall Adjustment Factor FOH**		0.9199
								0.920

Heat efficiency = (QHO x FOH)/(TFI x FOI)

Data Quality

- Meter Reading
- Data Logging
- Record keeping
- Calibration
  - Regular schedule
  - (<2MWe)