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Water Flow Measurement

We have a portable ultrasonic flowmeter with clamp-on transducers of following specification:

Make : Flexim GmbH
Model : Flexus ADM 6725
Suitable for a large variety of liquids including water
For detailed spec refer website of Flexim



We are using this instrument for last two years and there has not been any problem so far.

We are using this instrument in the following ways:

- 1) Measurement of existing flow for various cooling water line and also for Rolling oil (Mineral oil) systems used in our Rolling Mills. The operating point of the pump is then determined for a given pressure using the pump efficiency curve and thereby the efficiency of the system. We have replaced a number of pumps where we had found that the pump is operating at a low efficiency point.
- 2) In an old plant, there can be many pumps without any name plate and specification details. We also had a number of pumps without any details. We have first measured the existing flow and head with which the system is operating satisfactorily. We have measured the power required for the existing pump motor set and compared it with expected power requirement for a new pump-motor set suitable for the application. We have replaced number of old pumps, where we had found that there is a large gap between the two. There were absolutely no failures and there were substantial savings achieved.
- 3) We have also used this instrument to measure the flow through Heat Exchangers.

- 4) We are also using this instrument for regular calibration of all the flow meters connected to various systems in our plant.

Precautions:

Readings may be erroneous if there is scales inside the tube carrying the liquid (especially for water). In such cases we have replaced a small section of the pipeline with a new pipe and have measured the flow at the new pipe section.

Computerized Open Channel Flow Measurement using V-Notch

V-Notch is used to measure flow in an open channel. Height of water above the apex of the V-Notch is measured and empirical formulas are used to derive the flow from the measured height. Construction of V-Notch have been discussed in IS- 9108 We have utilized one such V-Notch for measurement of plant effluent discharge. We have installed a flow measurement system using ultrasonic height measurement. We have also connected 4-20 ma output from this totaliser to a computer with suitable A-D converter to store on-line data in the computer to give hourly/daily trends etc.

Effluent discharge is directly proportional to consumption of water and this flow measurement system has given us tremendous benefit in conservation of water through monitoring the effluent, analyzing trends and pin pointing deviations. We are using this measurement system for last 4 years and there has been no failure so far.

Precautions:

Care needs to be taken for fixing of the V-Notch in the open channel. The side walls to be sealed properly to prevent water leakage through the side wall otherwise the measured flow becomes erroneous.

We have devised procedure for periodic calibration of the system.

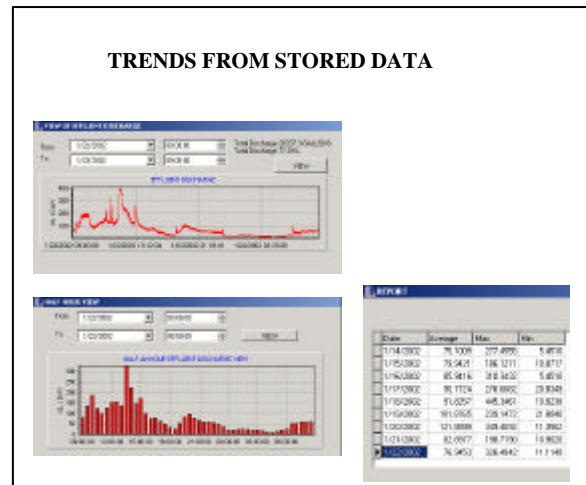
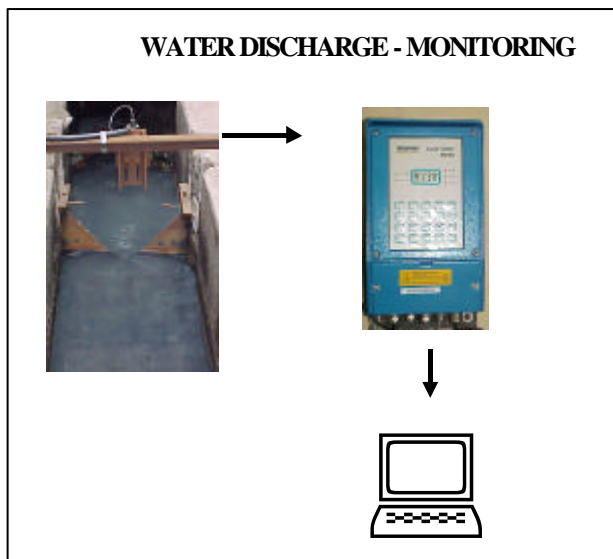
Specification :

Level-Sonic Non Contact level gauging using ultrasonic waves

Model : BM 90

Make : Krohne

Refer website of Krohne for detailed spec



VFD output & Data Acquisition Technique for Flow Measurement

It is always not possible to install expensive Flow measurement system at each and every place. Indirect methods may be used utilising existing system. This is an example of such a system. We have a borewell pump to draw sub-soil water which is again connected with a VFD (Variable Frequency Drive). Through pressure sensing, the speed of the motor is varied to match pumping rate to requirement. This is required as we do not have any centralized overhead water reservoir. Thus the speed of the pump keeps on varying through out the day based on instantaneous water demand. We wanted to monitor the consumption continuously, have trends etc. This was not possible with the existing mechanical type flow meter connected to the system. Analogue signal output of 0-10 V (corresponding to frequency output) was taken from the VFD and fed to a computer using suitable A-D converter module for continuous data acquisition and storage. A spare channel of an A-D converter already connected to a computer was used and thus there was practically no additional expenditure. System was calibrated using clamp-on type Flow meter. Flow was measured using the clamp-on type flow meter corresponding to different speed (frequency output of VFD) of the pump. This was plotted to get a smooth curve and the data was fed in the computer to get real time plot

Although we have not attempted to determine the system accuracy, it is very much possible to determine the same using more number of data points. The system calibration will get disturbed once there is any change in the pump efficiency and thus the system needs periodic calibration.

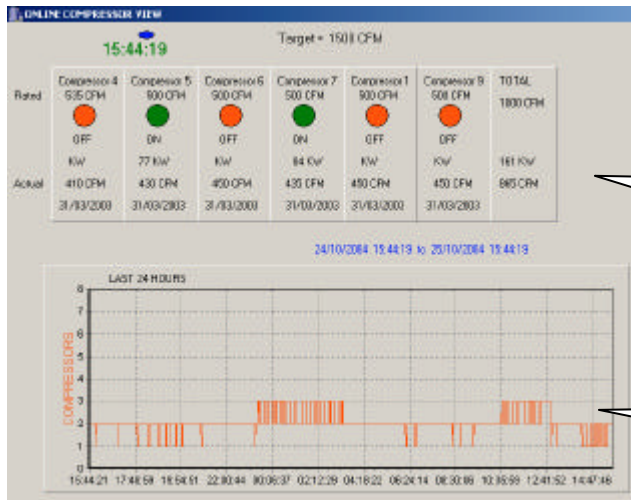
This system has helped us to monitor continuously and have trends for water consumption thereby helping to conserve both water and energy.

Air Flow Measurement

We measure the air flow of Fans (open to air) like cooling tower fans, cooling fans using Anemometer. For measurement of air flow through a duct, pitot tubes is used. However such measurements are only occasional.

Although we have the desire, we have so far not been able to have an direct on-line compressed air flow measurement system at our plant for regular use and monitoring. We have however devised an indirect method for continuous monitoring of compressed air usage in the plant. We have compressed air system in a ring main and have installed pressure optimizer & automatic ON/OFF of compressor and thus it is essential that we know the details of compressor operation for maximum benefit. We have a total of 6 compressors of 500 CFM capacity of which 2/3 are in operation based on system requirement. Each of these compressors have individual Power Meters with communication port. A central computer collects data form each of these Power meters at an interval of 15 secs. The On/Off/Loading/Unloading status of the compressors is reflected in the kW drawn for each of the compressors and which is captured in the computer. Periodic Free Air Delivery of the compressors are measured. Instantaneous air generation/requirement is therefore summation

of the Free Air Delivery of the specific compressors in use at that point of time with status (Load/un-load). The customized computer program provides instantaneous air generation/requirement status based on predetermined compressor capacity measurement and on-line status information. This information is used for daily/weekly usage trend. Over usage and or inefficiency is reflected in weekly data trend. Such information also occupies a place in plant weekly Energy report which is circulated amongst all concerned including the chief executive.



on-line Status

Trend showing number of compressors in operation

The screenshot displays the 'CFM REPORTS' interface. It shows a date range from '12/10/2004' to '12/10/2004'. Below this is a table of compressor performance metrics:

COMP NAME	COMP4	COMP5	COMP6	COMP7	COMP8	COMP9			TOTAL
RATED CAPACITY	535	500	500	500	500	500	0	0	
ACT CAPACITY	410	430	450	430	450	450	0	0	
TOTAL HOURS	11.25	11.14	6.51	13.44	10.75	13.38	0.00	0.00	66
LOAD HOURS	10.93	11.85	4.07	12.37	11.06	13.15	0.00	0.00	52
% LOAD	81	85	90	86	90	90	0	0	79
CFM USED	6383	4069	4404	6718	5167	6660	0	0	39622
CFM GENERATED	4483	1571	1834	5351	3028	5916	0	0	23013
START kWh	620580	309684	399200	631704	611808	391048	0	0	
END kWh	623440	304088	395670	626821	612958	392598	0	0	
CONSUMPTION	348	344	420	1847	730	1070	0	0	4491
CFM/kWh	4.6	4.6	4.4	5.1	7.2	5.9	0	0	5.1

Report showing CFM utilised during a specific period of time

Measurement of % O₂, % CO₂ & %CO of Stack emission

KM-900 PORTABLE FLUE GAS ANALYSER

Make : NEVCO

O₂..... 0-21%
CO..... 0-10000 ppm or 0-10 %
CO₂..... 0-21%
NO (Optional)..... 0-5000 ppm
Lsses..... 0-99.9%
Draft(Optional)....150 mbar
Temperature(nett)....0-1300oC
Inlet Temp.....0-50°C
Excess Air.....0-2885.0%
CO/CO₂ ratio.....0-0.9999



We have one portable Combustion analyser of above spec

This instrument has been procured by us about 2 years back and we have been using the instrument for periodic measurement of the flue gas composition. We have changed the gas cells and have also checked the calibration of the instrument in-between.

The measurement is done in the flue stack before recuperator and with dilution system kept off. Measurements are done at both high fire and at low fire state. Furnace is kept at a slightly positive pressure of 0.2 mmWC.