

BREVET D'ETUDES PROFESSIONNELLES
MAINTENANCE DES EQUIPEMENTS
DE COMMANDE DES SYSTEMES
INDUSTRIELS

LANGUE VIVANTE ANGLAIS

Durée : 1 h 30

L'usage du dictionnaire bilingue est autorisé.

Ce sujet comporte 4 pages

Ultrasonic Flowmeters

Liquid and gaseous products

ALTOSONIC ultrasonic flowmeters are designed for flowmetering almost anything, whether liquid or gaseous, aggressive or corrosive.

Oils and water, fuels and waxes, acids and alkalis, oxygen and nitrogen, milk and wine, solvents and paints ... to name just a few.

You'll find a suitable flowmeter for every application.

Measurement is independent of electrical conductivity, viscosity, temperature, density and pressure.

The unimpeded flow cross-section rules out accumulation of deposits, pressure losses and wear.

The sole requirements are acoustic transmissivity, low entrained gas and solids contents in liquid products, and extremely inhomogeneously distributed solids or moisture in gaseous products.

Quality and adaptability

ALTOSONIC ultrasonic flowmeters are produced by Krohne to ISO 9001 certified quality standards.

For application even under difficult process conditions such as . . .

- contamination, sun, rain and snow
- laminar or turbulent flow
- interference frequencies and vibration
- high process temperatures, temperature shocks and high-temperature steam cleaning

The ALTOSONIC product range covers . . .

- compact and separate systems with a choice of flanged connections,
- clamp-on sensors that are simply fitted to the outside wall of the pipeline, or
- built-in sensors for existing pipelines or open channels and raceways.
- Use in hazardous areas is also possible.

ALTOSONIC ultrasonic flowmeters for . . .

- measurement of the volumetric flowrate
- volume flow counting
- F/R mode, forward / reverse flow measurement
- fast response time, less than 20 ms, for batching and sampling tasks
- measurement of the transit time and sound velocity for product identification, e. g. when switching from product to cleaning agent
- local display, current, pulse and status outputs
- digital interfaces
- low-flow cutoff
- turndown ratios up to 1 : 100

Measuring principle

All Krohne ultrasonic flowmeters operate to the transit-time differential method.

Transit-time differential measurement is based on a simple physical fact.

Imagine two canoes crossing a river on the same diagonal line, one with the flow and the other against the flow. The canoe moving with the flow needs much less time to reach the opposite bank.

Ultrasonic waves behave in exactly the same way. A sound wave travelling in the direction of flow of the product is propagated at a faster rate than one travelling against the flow ($v_{AB} > v_{BA}$).

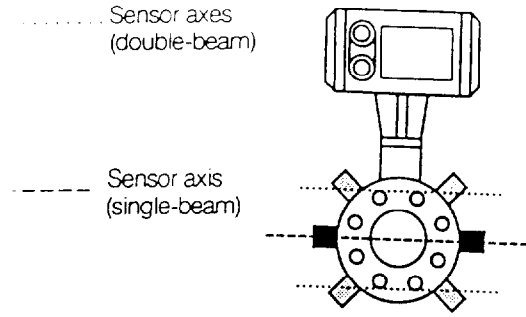
Transit times t_{AB} and t_{BA} are measured continuously. The difference ($t_{BA} - t_{AB}$) in time travelled by the two ultrasonic waves is directly proportional to the mean flow velocity (v_m) of the product.

The volumetric flowrate per unit time is the product of the mean flow velocity (v_m) multiplied by the pipe cross-section.

A liquid product is identified by direct measurement of the transit time of ultrasonic waves. Assuming the same path length (L), the transit time in water is shorter than in crude oil, for example.

Installation

Location and position as required, but sensor axis must be approximately horizontal if flowmeter installed in slightly ascending horizontal pipe runs.



Measuring tube must be completely filled at all times.

Flanges and nuts: to install, make sure there is sufficient room next to pipe flanges.

Support: support the pipeline on both sides of the flowmeter.

Large meter sizes, DN > 200 (> 8"): use adapter pipes to permit axial shifting of counterflanges to facilitate installation.

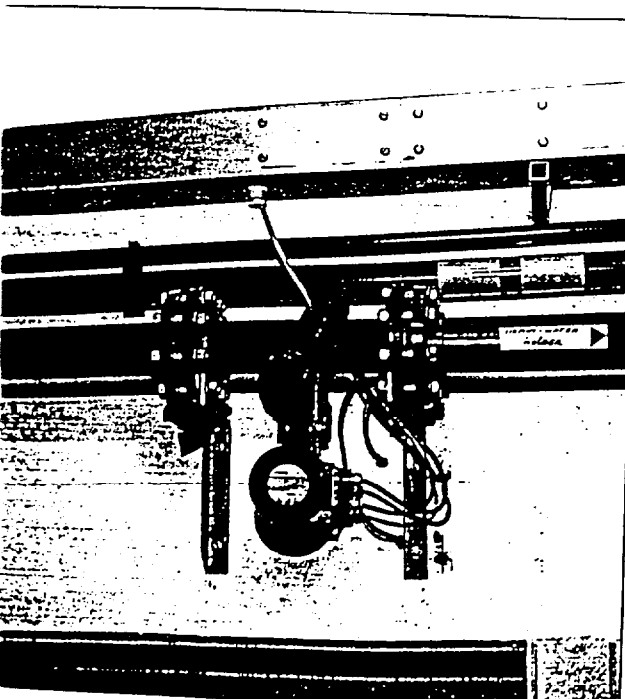
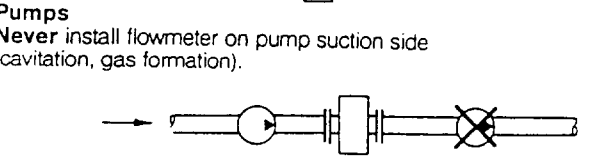
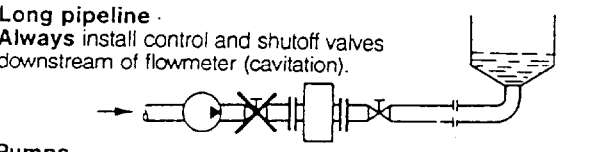
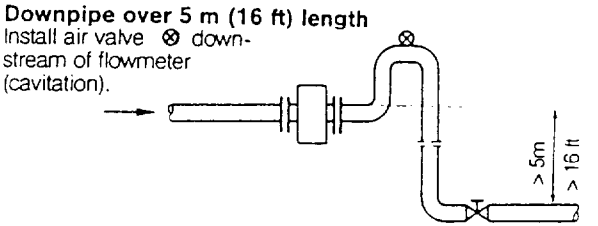
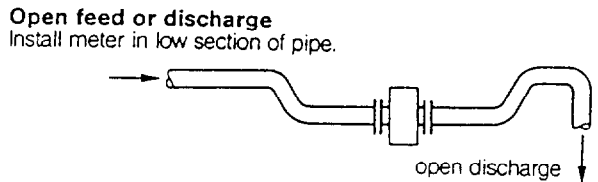
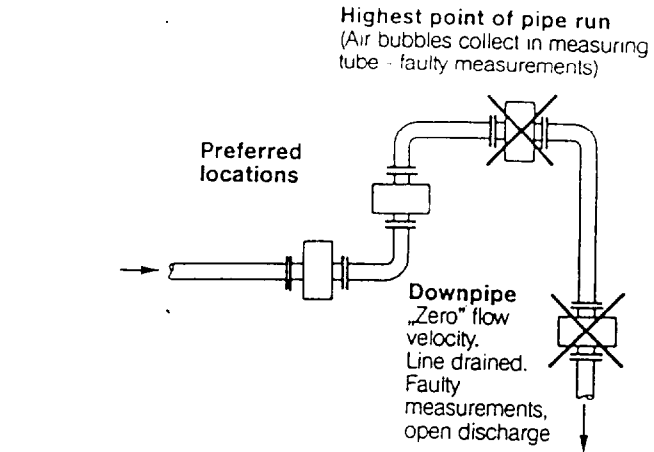
Reverse or corkscrew flow: increase inlet and outlet sections or install flow straighteners.

Changing different fluid products. Install flowmeter upstream of change point or at an adequate distance downstream, minimum 5 DN (DN = meter size), otherwise output/display may be faulty.

Insulated pipeline: do not insulate the flowmeters.

Suggestions for installation

To avoid measuring errors due to air inclusion, please observe the following:



TRAVAIL A FAIRE PAR LE CANDIDAT

I - Rédigez un compte rendu en français en abordant les points suivants : 8 pts

- 1 - Ce qu'il est possible de mesurer à l'aide du débitmètre à ultrasons Altosonic.
Vous citerez au moins 4 fluides.
- 2 - Dans quelles conditions on peut utiliser cet appareil. Vous citerez au moins 3 types de conditions de fonctionnement extrêmes.
- 3 - Les 2 types de capteurs existant dans la gamme des produits Altosonic.
- 4 - Les 4 erreurs à éviter lors du montage.

II - Traduire le paragraphe "Measuring principle" (entre crochets). 6 pts

III - Répondez en anglais aux questions suivantes en formulant des phrases complètes. 6 pts

- 1 - Is measurement correct in the case of a high temperature liquid ?
Justify your answer.
- 2 - Give 2 points you must check before operating the ultrasonic flowmeter.
- 3 - What enables sampling tasks ?
- 4 - Is the transit time always the same ? Explain by giving an example.
What can you identify with it ?
- 5 - Should you insulate the flowmeter in any case ?

I - Compte rendu

8 pts

(Ne pas enlever plus d'un point pour la qualité de la rédaction)

- 1 - A l'aide du débitmètre à ultrasons Altosonic, on peut mesurer presque tout : fluides liquides ou gazeux, agressifs ou corrosifs (huiles, eaux, carburants, cires, acides, alcalis, oxygène, azote, lait, vin, solvants, peintures...).
- 2 - (3 exemples suffisent).
On peut utiliser cet appareil dans des conditions de fonctionnement extrêmes telles que :
 - atmosphères agressives, soleil, pluie et neige
 - écoulements laminaires et turbulents
 - fréquences parasites et fortes vibrations
 - températures de service extrêmes, chocs thermiques, nettoyage à la vapeur surchauffée.
- 3 - Les 2 types de capteurs :
 - Capteurs à montage externe qui se fixent simplement sur l'extérieur de la conduite.
 - Capteurs à souder sur des conduites existantes ou sur canaux ouverts (ou capteurs intégrés).
- 4 - Les 4 erreurs à éviter lors du montage sont :
 - Eviter le point le plus élevé de la conduite (accumulation des bulles d'air dans le tube de mesure).
 - Eviter de monter sur conduites verticales (la conduite se vide).
 - Pour les conduites longues : ne pas oublier d'installer des vannes d'isolement en aval du capteur.
 - Pour les pompes : ne pas monter le capteur à l'aspiration d'une pompe.

II - Traduction

6 pts

Principe de mesure.

Tous les débitmètres à ultrasons Krohne utilisent la différence de temps de transit des ondes. **(1 pt)**

La mesure de la différence de temps de transit est basée sur un principe physique simple. **(1 pt)**

Imaginons deux canoës-kayaks qui traversent un fleuve sur la même ligne diagonale, l'un des deux dans le sens du courant et l'autre à contre-courant. **(1 pt)**

Le canoë qui se déplace dans le sens du courant aura besoin de beaucoup moins de temps pour atteindre la rive opposée. **(1 pt)**

Le même phénomène s'applique aux ultrasons. **(1 pt)**

Une onde sonore se propage plus rapidement dans le sens d'écoulement d'un fluide que dans le sens opposé. **(1 pt)**

III - Questions.

6 pts

(on évaluera notamment la qualité de l'expression ; nécessité de phrases complètes)

- 1 - Yes. Measurement is independent of temperature. **(1 pt)**
- 2 - * Acoustic transmissivity.
 - * Low entrained gas and solids contents in liquid products.
 - * Extremely inhomogeneously distributed solids or moisture in gaseous products. **(2 pts)**
- 3 - Fast response time (less than 20 ms) enables sampling tasks. **(1 pt)**
- 4 - No. Example : the transit time in water is shorter than in crude oil. You can identify a liquid product. **(1 pt)**
- 5 - No, if the pipeline is already insulated. **(1 pt)**

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