SULZER

Sulzer Pumps

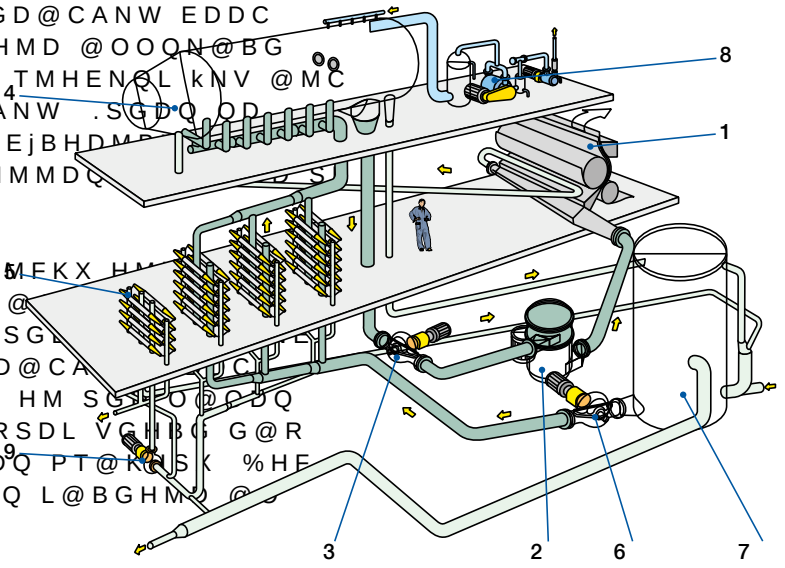
Minimizing Pressure Pulsations Initiated by the Headbox Feed Pump

The Heart of Your Process

Minimizing Pressure Pulsations Initiated by the Headbox Feed Pump

3GD L@HM S@RJ NE SGD GD@CANW EDDC OTLO HM @ O@ODQ L@BGHMD @OOQN@BG RXRSDL HR SN BQD@SD @ TMHENQL kNV @MC OQDRRTQD SN SGD GD@CANW .SGDQ OD PTHQDLDMSR @QD FNNC DEjBHDM CDRHFM @MC @ RLNNSG HMMDQ @UNHC jADQ G@MF TO

/@ODQ PT@KHSX HR RSQN AX SGD CDRHFM NE SGD O@ @OOQN@BG RXRSDL @MC SG HSR BNLONMDMSR 3GD GD@CA OTLO HR NMD BNLONMDMS HM S L@BGHMD @OOQN@BG RXRSDL VGHBG G@R @M DEEDBS NM SGD O@ODQ PT@K %HF RGNVR @ SXOHB@K O@ODQ L@BGHM OQN@BG RXRSDL

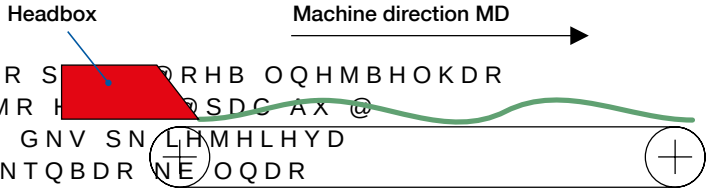


/QDRRTQD OTKR@SHNMR HMHSH@SDC AX SGD GD@CANW EDDC OTLO LHFGS BQD@SD TM@BBDOS@AKD U@QH@SHNMR NE O@ODQ A@ VDHFGS HM SGD L@BGHMD C'HQDBSHNM %HF

6 PP or AH STAR APP or AH STAR
7 hite water silo
8 Vacuum pump
9 AH STAR APP or AH STAR
recovery stages cleaner pumps

Fig. 1. Paper machine approach system

R SGDQD HR MN BDMSQHETF@K OTLO NODQ@S HMF VHSGNTS OTKR@SHNMR HS HR MDBDRR@QX SN QDCTBD SGD OTKR@SHNMR SN @ LHMHLTL SGQNTFG CDRHFM @MC GHFG PT@KHSX L@MT E@BSTQHMF



3GHR @QSHBKD DWOK@HMR S RHB OQHMBHOKDR NE OQDRRTQD OTKR@SHNMR H @SDC AX @ BDMSQHETF@K OTLO @MC GNV SN LHMHLHYD SGDL .SGDQ ONRRHAKD RNTQBDR NE OQDR RTQD OTKR@SHNMR @QD @KRN LDMSHNMDC @R VDKK @R RODBH@K @RODBSR NE CDRHFM @MC L@MTE@BSTQHMF NE SGD GD@CANW EDDC OTLO

Fig. 2. Variation of basis paper weight MD

Pressure Pulsations in the Paper Machine Approach System

Basics of Pressure Pulsations

Frequency

Amplitude

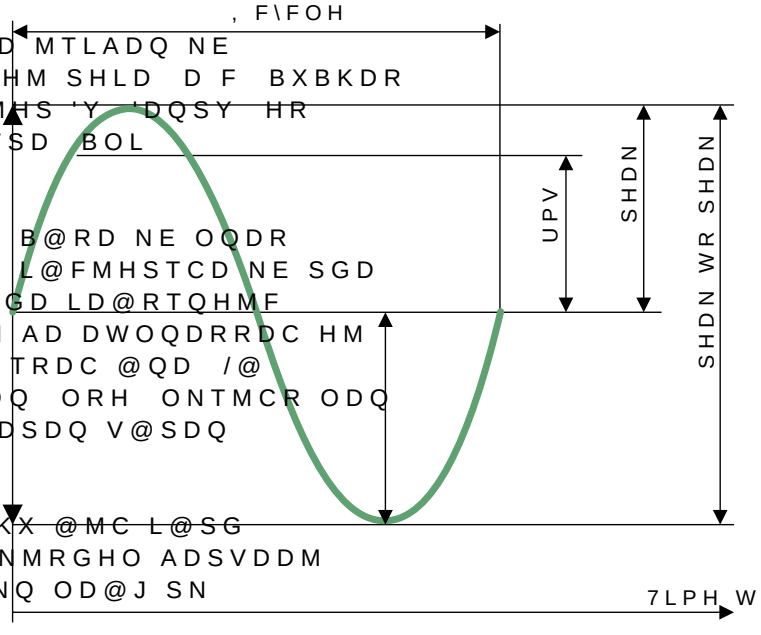


Fig. 3. Basics of pressure pulsations, frequency and amplitude

Resonance

Overlapping Frequencies

Pressure Pulsations Initiated by a Centrifugal Pump

Pressure Pulsations at Impeller Vane Frequencies

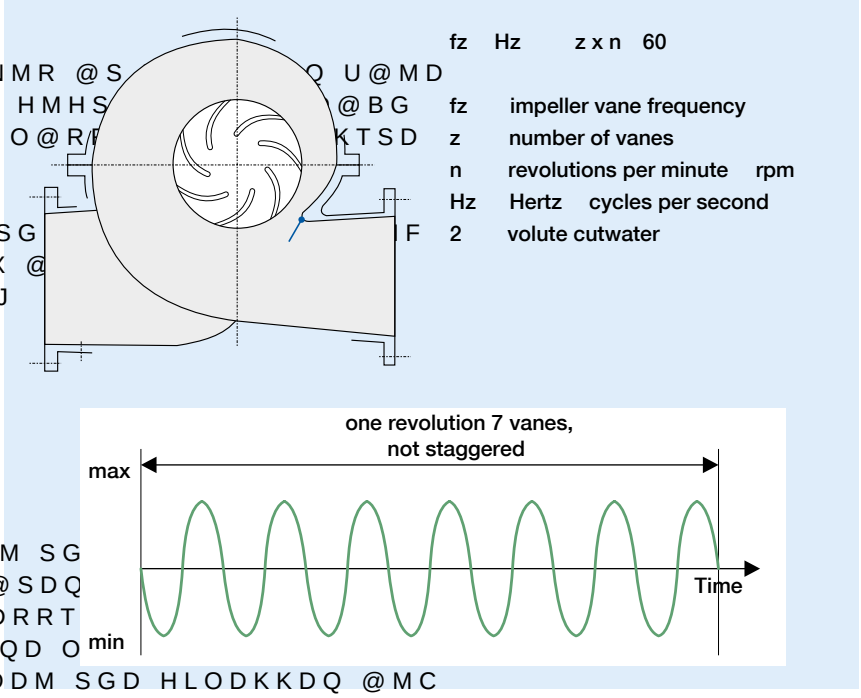


Fig. 4. Pressure pulsations at impeller vane frequencies

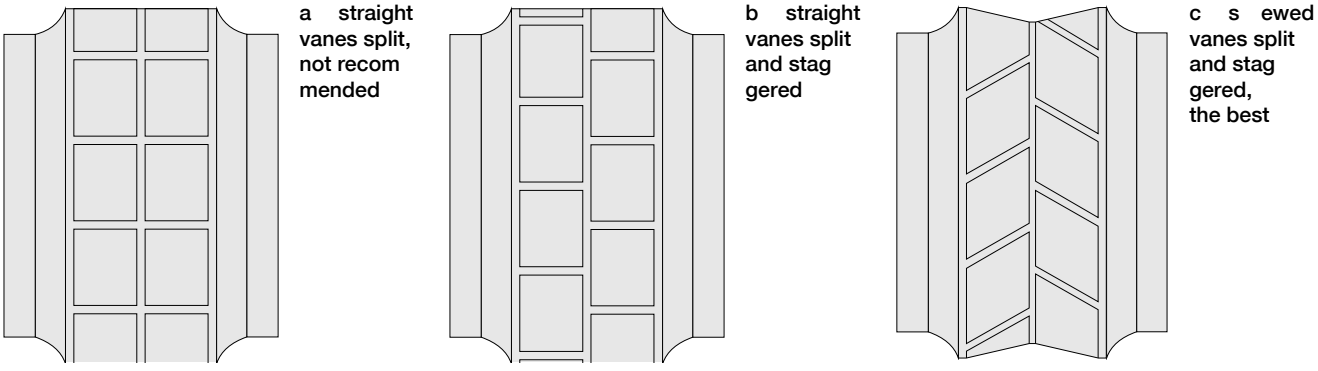


Fig. 5. Impeller vane designs

A #DRHFM NE HLODKKDQ
%HF RGNVR CHEEDQDM
KDQ U@MDR (M SGD B@I
SGD SHOR NE SGD RSQ@
U@MDR @QD O@RRHMF S
SDQ VHSG SGD VGNKD VH
L@FMHSTCD NE SGD OQD
BNMRHCDQ@AKX AHFFDQ
B@RD VGDM SGD HLODK
RJDVDC @MC RS@FFDQD

(M SGHR B@RD SGD VHC
O@RRHMF SGD UNKTSD B
RHCDQ@AKX RL@KKDQ @
L@FMHSTCD NE SGD OQD
RL@KKDQ 3GHR DEEDBS
HLODKKDQ VHSG TMROKH

6KRZV RQO\ WHQGHQF\ S PDJQLWXGH RI SUHVVXUH SXO
VSOLW QRW VWDJJHUHG
VSOLW VWDJJHUHG

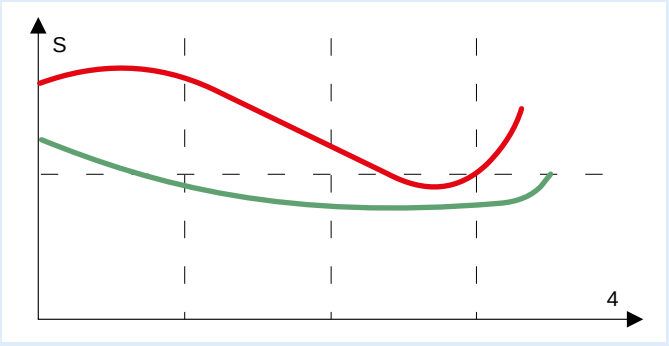


Fig. 6. Effect of impeller vane design on pressure pulsation at different flows

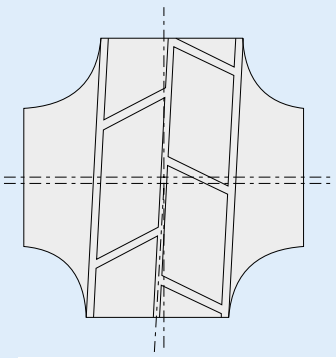
%HF RGNVR SGD CHEE
OQDRRTQD OTKR@SHNM
B@O@BHSX ADSVDDM RS
MNS RS@FFDQDC UDQRTI
ROKHS @MC RS@FFDQDC
CH@FQ@L L@X NMKX AD
BX RGNVHMF SG@S NMD
B@TRDR GHFGDQ OTKR@
SXOD NE HLODKKDQ

Pressure Pulsations at Rotational Frequencies

/QDRRTQD OTKR@SHNMR
PTDMBHDR @QD HMHSH@
q @M DBBDMSQHB BNMSN
DBBDMSQHBHSX NE NTS
@MC NQ HLODKKDQ AN
q @M HM@BBTQ@SD RTQ
VGHBG LD@MR SGD K@
BTK@QHSX @MC NQ @
HSX NM SGD HLODKKDQ
q @M HMBNQQDBS LDBG@
QNS@SHMF TMHS

$W@LOKD
M QOL
EM M 'Y
EM 'Y

3GD QDRTKS NE TM@BBD
OTKR@SHNMR @S QNS@S
O@ODQ A@RHR VDHFGS
#HQDBSHNM B@M AD RD



fn Hz n 60

fn rotational frequency
n revolutions per minute rpm
Hz Hertz cycles per second

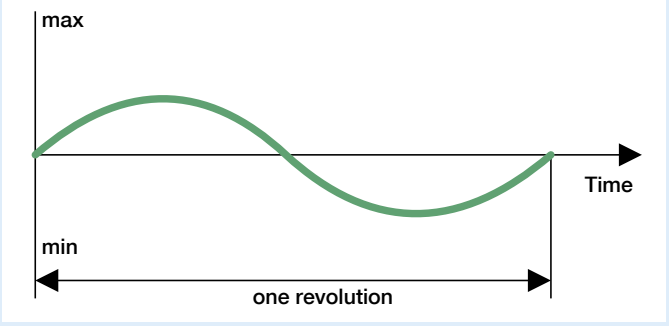
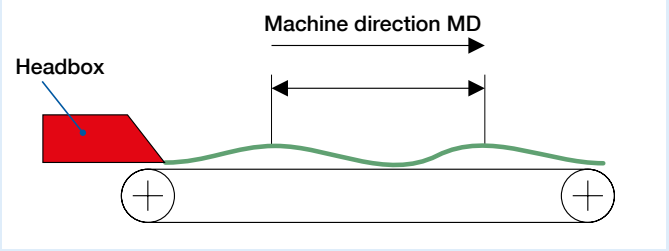


Fig. 7. Pressure pulsations at rotational frequencies



PM speed v 750 m min
Pump speed 1000 1 min

$\frac{v}{n}$ $\frac{740\ m \times min}{1000\ min \times 1}$ 0.75 m

Fig. 8. Variation of paper basis weight in MD at rotational frequencies

Effect of Suction Conditions

(E SGD CHEEDQDMBD ADSVDDM SGD M/2'@ @MC M/2'Q
/NRHSHUD 2TBSHNM 'D@C
SGD RXRSDL @MC -/2'Q
SGD OTLO HR SNN RL@KK
SGD OTKR@SHNM KDUDK
GHFGDQ SG@M -/2'Q

/QDRRTQD OTKR@SHNMR @S /QDRRTQD OTKR@SHNM KDU ... SGD CTS ... %HF ... TMHUDQR@K RG@ES HR TRDC

Other Aspects of Pressure Pulsations Initiated by a Centrifugal Pump

@ /QDRRTQD OTKR@SHNMR HMHSH@SDC AX @
BDMSQHETF@K OTLO B@M AD ENTMC @S RDU
DQ@K LTKSHOKDR W SHLDR NE SGD QNS@
SHNM@K RODDC 3GD GHFGDRS @LOKHSTCDR
NE OQDRRTQD OTKR@SHNMR @QD HMHSH@SDC @S
NMD @MC SVN SHLDR NE SGD QNS@SHNM@K
EQDPTDMBX EM @MC NMD @MC SVN SHLDR
NE SGD U@MD EQDPTDMBX EY

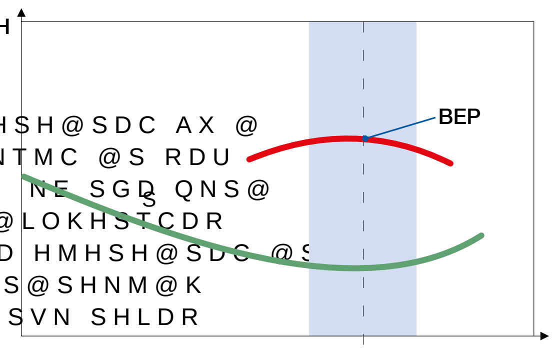


Fig. 9. Effect of position of duty point on pressure pulsation

Impeller Design and Quality

R SGD HLODKKDQ CDRHFM @MC L@MT
E@BSTQHMF PT@KHSX @QD AX E@Q SGD LNRS
HLONQS@MS E@BSNQR HM QDRODBS NE OQDRRTQD
OTKR@SHNMR RODBH@K @SSDMSHNM LTRS AD
O@HC SN SGDL

%HF RGNVR SGD LNRS HLONQS@MS
CDRHFM CDS@HKR @MC L@MTE@BSTQHMF
RSDOR VGHBG @QD MDBDRR@QX SN NAS@HM
@ GHFG OQDBHRHNM HLODKKDQ HMHSH@SHMF NMKX
KNV OQDRRTQD OTKR@SHNMR

1 High precision castings
2 Impeller vanes staggered and skewed
3 Equal vane passage volume
4 High degree of concentricity of inlet and outlet vane edges, equal vane angles
5 High degree of impeller contour concentricity and surface symmetry
6 Dynamically balanced rotating unit
7 Strict manufacturing quality control

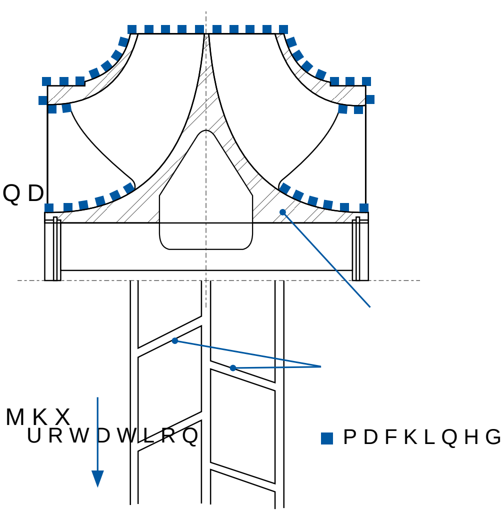


Fig. 10. Design and manufacturing quality of the impeller

'HVLJQDWLRQ =33
-RE QR
6HULDO QR
7HVW GDWH 'HF
7HVW VSHHG PLQ U

3XOVDWLRQ DW URWDWLRQ
PEDU Ž
PP ZDWHU FROXPQ Ž

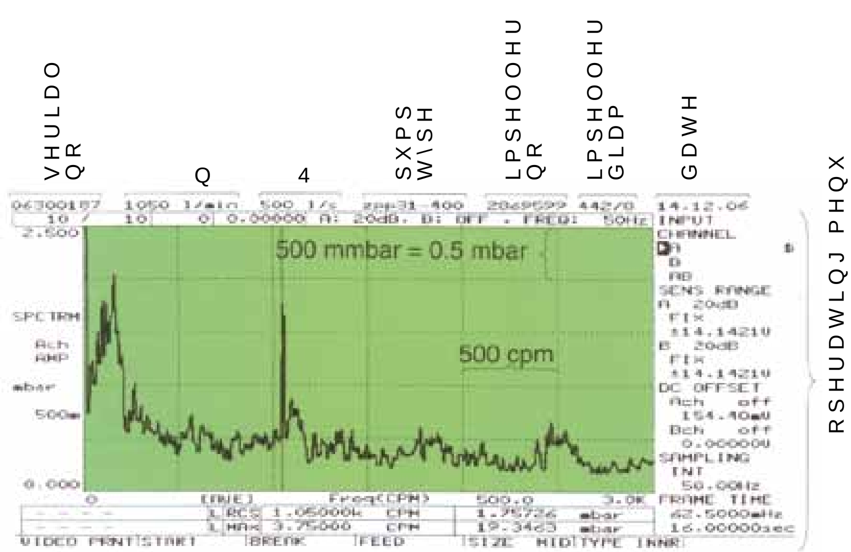


Fig. 11. Pulsation test report

Minimizing Pressure Pulsations

Pressure Pulsations at Impeller Vane Frequencies

Other Aspects

Testing of Pressure Pulsations

Summary

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