

September 30, 2021

Pennakem

Subject: September vibration service report

Most of the machines surveyed were found to be in good condition, with the exception of the following:

QualiTest® uses a four-step rating system for defects.

Class I: Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

Class II: Defect (s) present that may cause problem in long term (2-6 months.). Repair during normal maintenance scheduling. Continue to monitor.

Class III: Defect (s) present that may cause failure in short term (less than 2 months.). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

Class IV: Defect (s) present that makes continued reliability unpredictable, and possibility of secondary damage is high. Repairs should be made ASAP. An unscheduled shutdown should be considered for repairs

Hi-Speed Industrial Service tests and inspects industrial machinery and equipment and makes recommendations concerning maintenance and repairs based on its experience in the field of industrial repair and maintenance. The information contained herein is provided as an opinion only, not as a guaranty or warranty of the matters discussed herein.

This completes our assessment of your equipment for this survey. Thank you for your business and don't hesitate to call if you have any comments or questions.

Sincerely,

David W. Shook
Senior Reliability Specialists
Hi-Speed Industrial Service
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Observations

P 24 Big Blue Water Pump

The pump trend has increased again and is dominated by a shaft speed vibration. The pump data still indicates possible looseness in the bearing fits as well as wear in the pump, such as imbalance, and vane pass, which we suspect is 5x RPM. The motor data for the inboard bearing shows what we believe to be bearing fundamental outer race defect frequency and harmonics. **Rated a Class III Defect.**

P24-85 Degree Pump North

The pump has a slight shaft speed vibration which is dominant in the axial of both bearings. No immediate action indicated. **Rated a Class I Defect.**

P24-85 Degree Pump South

The pump axial vibrations are still elevated. Shaft speed harmonics are in the data. The acceleration trend is 3 g's RMS but looks to be some cavitation noise. Ensure the pump is running at BOP. We suspect slight looseness in the shaft or bearing fits. **Rated a Class I Defect.**

P36-905C-72 North Cooling Tower East Pump

The pump inboard bearing vibration has substantially dropped and needs no further attention.

CHLR45-1 20 Ton Trane Chiller

The West compressor was running and vibrating at over 1.0"/sec velocity peak at 60 Hz shaft speed. Vibrations at this levels in either unit will likely cause a reduced lifespan. Have the unit checked for compliance with the manufacture's specification. **Rated a Class I Defect.**

P 48-7B Rotojet High Pressure Pump

The pump vibration has substantially dropped and needs no further attention.

R53-301 Reactor Agitator Motor and Gearbox

The motor vibrations are still almost all near 0.5"/sec velocity peak. The vibrations are dominated by shaft speed and the first two harmonics. This usually indicates a coupling and/or an alignment issue. We recommend inspecting the motor and coupling, and check the shaft alignment, fasteners and frame as time allows. **Rated a Class II Defect.**

R55-106 Reactor Agitator Motor Gearbox

Motor has what looks to be a strong 1xRPM vibration still that varies in amplitude. Inspect the fasteners, structure, coupling and alignment as time allows. **Rated a Class II Defect.**

C67-51 Twin Screw Axial Compressor Motor

Vibration data for the outboard motor bearing still shows synchronous and non-synchronous peaks. We suspect outer race bearing defect frequencies are present. Overall acceleration is near 4 g's RMS. No immediate action is required; however, we are keeping this a **Class II Defect for now.**

C67-51 Twin Screw Axial Compressor End

The lobe pass vibrations at 2x and 4x input speed are dominant in the data but have not changed. Loading could affect vibrations. **Rated a Class I Defect.**

P67-504 Hot Oil Circulation Pump 50 HP

The unit vibrations have dropped significantly. We still suggest inspecting the coupling and alignment. Check for run out. **Rated a Class I Defect.**

R80-10 Agitator Motor and Gearbox

The motor overall vibrations are low due to the slow rotation speeds; however, the raw data suggest the bearings are in severe distress. The gearbox has some similar vibrations, but we believe they are from the motor. **We still recommend replacing the motor and inspecting the coupling and gearbox at the very next opportunity. Rated a Class IV Defect.**

R80-30 Agitator Motor and Gearbox

The motor has a dominant shaft speed vibration. Inspect the coupling fasteners and alignment as time allows. **Rated a Class I Defect.**

B82-101A Southwest FD Fan 10 HP (Outside)

The motor still has a 1x and 2x RPM vibration at the shaft end bearing. We recommend cleaning and inspecting the fan wheel/hub and check all fasteners. **Rated a Class I Defect.**

Abbreviated Last Measurement Summary

Database: penn.rbm
Station: PENNAKEM NEW CURRENT DATABASE
Report Date: 30-Sep-21 12:56

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
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B4C101-877 - ZURN BOILER BLOWER (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.171 In/Sec	.928 G-s	1180.0 RPM
12	.099 In/Sec	.303 G-s	
13	.098 In/Sec	.715 G-s	
21	.221 In/Sec	1.078 G-s	
22	.152 In/Sec	1.581 G-s	
23	.120 In/Sec	.552 G-s	
71	.178 In/Sec	1.194 G-s	
72	.119 In/Sec	1.298 G-s	
73	.210 In/Sec	.662 G-s	
81	.180 In/Sec	.807 G-s	
82	.104 In/Sec	.340 G-s	
P4C-102B - BOILER FEEDWATER PUMP (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.098 In/Sec	.576 G-s	3570.0 RPM
12	.030 In/Sec	.772 G-s	
21	.074 In/Sec	.192 G-s	
22	.042 In/Sec	.474 G-s	
23	.071 In/Sec	.495 G-s	
71	.050 In/Sec	.683 G-s	
72	.051 In/Sec	.996 G-s	
73	.061 In/Sec	1.111 G-s	
81	.095 In/Sec	.603 G-s	
82	.044 In/Sec	.739 G-s	
83	.119 In/Sec	.797 G-s	
P24-63DEGS - 63 DEG S WATER PUMP (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.083 In/Sec	.382 G-s	1750.0 RPM
12	.084 In/Sec	.448 G-s	
21	.079 In/Sec	.748 G-s	
22	.051 In/Sec	.672 G-s	
23	.070 In/Sec	.444 G-s	
71	.117 In/Sec	.379 G-s	
72	.071 In/Sec	.321 G-s	
73	.078 In/Sec	1.237 G-s	
81	.101 In/Sec	.616 G-s	
82	.059 In/Sec	.435 G-s	
83	.108 In/Sec	.668 G-s	
P24-85DEGN - 85 DEG N WATER CIRC PUMP 125 (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.083 In/Sec	.712 G-s	1750.0 RPM
12	.064 In/Sec	1.084 G-s	

21	.071 In/Sec	1.049 G-s
22	.070 In/Sec	.881 G-s
23	.048 In/Sec	.357 G-s
71	.160 In/Sec	1.553 G-s
72	.219 In/Sec	1.460 G-s
73	.315 In/Sec	1.370 G-s
81	.142 In/Sec	.822 G-s
82	.170 In/Sec	.851 G-s
83	.257 In/Sec	1.495 G-s

P24-85DEGS - 85 DEG S WATER CIRC PUMP 125 (27-Sep-21)

	OVERALL LEVEL	1-20 KHZ	
11	.107 In/Sec	.963 G-s	1750.0 RPM
12	.155 In/Sec	1.308 G-s	
21	.093 In/Sec	.896 G-s	
22	.064 In/Sec	.865 G-s	
23	.073 In/Sec	1.160 G-s	
71	.189 In/Sec	1.408 G-s	
72	.125 In/Sec	1.898 G-s	
73	.266 In/Sec	2.897 G-s	
81	.142 In/Sec	2.159 G-s	
82	.136 In/Sec	1.737 G-s	
83	.201 In/Sec	1.151 G-s	

P24BGBL876 - BIG BLUE WATER PUMP-63 DEG (27-Sep-21)

	OVERALL LEVEL	1-20 KHZ	
11	.309 In/Sec	1.654 G-s	1180.0 RPM
12	.060 In/Sec	1.855 G-s	
21	.318 In/Sec	2.896 G-s	
22	.060 In/Sec	2.879 G-s	
23	.089 In/Sec	.414 G-s	
71	.625 In/Sec	.191 G-s	
72	.192 In/Sec	.414 G-s	
73	.260 In/Sec	.274 G-s	
81	.521 In/Sec	.647 G-s	
82	.193 In/Sec	.721 G-s	
83	.226 In/Sec	.507 G-s	

P36-905C - N COOL TWR-EAST PUMP (27-Sep-21)

	OVERALL LEVEL	1-20 KHZ	
11	.041 In/Sec	.064 G-s	1780.0 RPM
12	.030 In/Sec	.199 G-s	
21	.031 In/Sec	.835 G-s	
22	.023 In/Sec	.142 G-s	
23	.027 In/Sec	.042 G-s	
71	.071 In/Sec	.886 G-s	
72	.075 In/Sec	1.209 G-s	
73	.098 In/Sec	.289 G-s	
81	.087 In/Sec	.774 G-s	
82	.103 In/Sec	.933 G-s	
83	.125 In/Sec	1.231 G-s	

C36-EAST - UTILITY AIRCOMP ROTARY 200HP (27-Sep-21)

	OVERALL LEVEL	1-20 KHZ	
11	.102 In/Sec	.620 G-s	1750.0 RPM
12	.080 In/Sec	.575 G-s	
21	.063 In/Sec	1.560 G-s	

22	.090 In/Sec	1.966 G-s	
23	.054 In/Sec	.724 G-s	
71	.132 In/Sec	1.964 G-s	3570.0 RPM
72	.139 In/Sec	2.975 G-s	
73	.141 In/Sec	3.830 G-s	
81	.133 In/Sec	8.577 G-s	
82	.138 In/Sec	4.880 G-s	
71F	.105 In/Sec	6.166 G-s	
72F	.120 In/Sec	3.604 G-s	
81F	.166 In/Sec	8.485 G-s	
82F	.164 In/Sec	4.886 G-s	
P39-4-877	- WELL PUMP #4	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	
11	.095 In/Sec	.416 G-s	1780.0 RPM
12	.161 In/Sec	.287 G-s	
21	.088 In/Sec	.563 G-s	
22	.100 In/Sec	.199 G-s	
23	.054 In/Sec	.167 G-s	
C42-4	- AXIAL TWIN SCREW COMPRESSOR	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	
11	.118 In/Sec	.821 G-s	1750.0 RPM
12	.070 In/Sec	.868 G-s	
13	.062 In/Sec	.409 G-s	
21	.114 In/Sec	1.119 G-s	
22	.084 In/Sec	1.630 G-s	
23	.081 In/Sec	.995 G-s	
71	.115 In/Sec	2.527 G-s	3570.0 RPM
72	.105 In/Sec	.232 G-s	
73	.093 In/Sec	5.498 G-s	
81	.075 In/Sec	2.547 G-s	
82	.053 In/Sec	.767 G-s	
83	.105 In/Sec	2.493 G-s	
71F	.178 In/Sec	3.462 G-s	
72F	.071 In/Sec	.938 G-s	
73F	.103 In/Sec	4.560 G-s	
81F	.135 In/Sec	.767 G-s	
82F	.050 In/Sec	1.824 G-s	
83F	.139 In/Sec	1.809 G-s	
P42-4A	- CENTRIFUGAL HOT OIL PUMP 5HP	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	
11	.035 In/Sec	.039 G-s	1760.0 RPM
21	.0098 In/Sec	.064 G-s	
23	.024 In/Sec	.031 G-s	
71	.021 In/Sec	.204 G-s	
73	.014 In/Sec	.087 G-s	
81	.022 In/Sec	.068 G-s	
P42-4B	- CENTRIFUGAL HOT OIL PUMP 5HP	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	
11	.033 In/Sec	.050 G-s	1760.0 RPM
21	.023 In/Sec	.178 G-s	
23	.041 In/Sec	.111 G-s	
71	.050 In/Sec	.122 G-s	
73	.024 In/Sec	.042 G-s	

81	.019 In/Sec	.084 G-s	
P42-4D - CENTRIFUGAL HOT OIL PUMP 5HP (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.029 In/Sec	.139 G-s	1760.0 RPM
21	.016 In/Sec	.085 G-s	
23	.024 In/Sec	.088 G-s	
71	.029 In/Sec	.160 G-s	
81	.026 In/Sec	.083 G-s	
P48-7B - ROTOJET HIGH PRESS PUMP 15HP (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.072 In/Sec	.183 G-s	1750.0 RPM
12	.082 In/Sec	.296 G-s	
21	.071 In/Sec	.726 G-s	
22	.171 In/Sec	.588 G-s	
23	.055 In/Sec	.407 G-s	
71	.264 In/Sec	2.237 G-s	
72	.134 In/Sec	3.020 G-s	
73	.072 In/Sec	.706 G-s	
81	.269 In/Sec	1.001 G-s	
82	.144 In/Sec	1.164 G-s	
83	.064 In/Sec	.815 G-s	
C53-1A-050 - C1-A H2 COMPRESSOR (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.080 In/Sec	1.733 G-s	1800.0 RPM
12	.035 In/Sec	1.005 G-s	
13	.084 In/Sec	.106 G-s	
21	.098 In/Sec	1.783 G-s	
22	.076 In/Sec	1.395 G-s	
23	.060 In/Sec	1.827 G-s	
71	.125 In/Sec	.056 G-s	
72	.023 In/Sec	.041 G-s	
73	.032 In/Sec	.060 G-s	
81	.122 In/Sec	.030 G-s	
82	.026 In/Sec	.061 G-s	
C53-301B - C-301B RECIP COMPRESSOR (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.050 In/Sec	.389 G-s	1800.0 RPM
12	.046 In/Sec	.668 G-s	
13	.048 In/Sec	.200 G-s	
21	.055 In/Sec	.210 G-s	
22	.042 In/Sec	.841 G-s	
23	.055 In/Sec	.036 G-s	
71	.055 In/Sec	.101 G-s	237.0 RPM
72	.030 In/Sec	.066 G-s	
73	.083 In/Sec	.041 G-s	
81	.055 In/Sec	.081 G-s	
82	.034 In/Sec	.059 G-s	
P53-301 - ANSI CENTRIFUGAL PUMP 50 HP (27-Sep-21)			
	OVERALL LEVEL	1-20 KHZ	
11	.095 In/Sec	.185 G-s	1750.0 RPM
12	.089 In/Sec	.559 G-s	
13	.087 In/Sec	1.241 G-s	

21	.106 In/Sec	.315 G-s
22	.146 In/Sec	.345 G-s
23	.096 In/Sec	.785 G-s
71	.063 In/Sec	.443 G-s
72	.105 In/Sec	.403 G-s

R53-301 - AGITATOR GBX CHEMINEER 15HP (27-Sep-21)

OVERALL LEVEL

11	.358 In/Sec	1760.0 RPM
12	.237 In/Sec	
21	.337 In/Sec	
22	.279 In/Sec	
23	.501 In/Sec	
31	.306 In/Sec	
32	.063 In/Sec	
33	.247 In/Sec	
41	.219 In/Sec	
42	.057 In/Sec	
51	.255 In/Sec	
61	.141 In/Sec	
63	.052 In/Sec	
71	.064 In/Sec	

P53-310A - GRUNDFOSS VERT PUMP 10HP (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.073 In/Sec	.074 G-s	1750.0 RPM
12	.079 In/Sec	.383 G-s	
21	.082 In/Sec	.112 G-s	
22	.073 In/Sec	.213 G-s	
23	.032 In/Sec	.394 G-s	
71	.078 In/Sec	.146 G-s	
72	.108 In/Sec	.171 G-s	
73	.034 In/Sec	.178 G-s	
81	.020 In/Sec	.060 G-s	
82	.039 In/Sec	.160 G-s	

C54--115 - COMP 2CYL 2 STAGE 75 HP (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.084 In/Sec	.663 G-s	1800.0 RPM
12	.145 In/Sec	.113 G-s	
21	.086 In/Sec	.751 G-s	
22	.064 In/Sec	.430 G-s	
23	.146 In/Sec	.279 G-s	
71	.027 In/Sec	.055 G-s	
72	.063 In/Sec	.036 G-s	
73	.047 In/Sec	.054 G-s	
81	.032 In/Sec	.039 G-s	
82	.021 In/Sec	.042 G-s	

P54-112 - CANNED MOTOR CENTRIFUG PUMP (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.040 In/Sec	.019 G-s	1800.0 RPM
12	.023 In/Sec	.054 G-s	
13	.051 In/Sec	.034 G-s	
21	.027 In/Sec	.090 G-s	
22	.020 In/Sec	.144 G-s	
71	.028 In/Sec	.071 G-s	

72	.023 In/Sec	.070 G-s	
81	.023 In/Sec	.043 G-s	
82	.046 In/Sec	.046 G-s	
R55-101	- AGITATOR GBX AND MOTOR	(27-Sep-21)	
	OVERALL LEVEL		
11	.151 In/Sec		1760.0 RPM
12	.058 In/Sec		
21	.141 In/Sec		
22	.053 In/Sec		
23	.074 In/Sec		
31	.125 In/Sec		
32	.016 In/Sec		
33	.054 In/Sec		
41	.140 In/Sec		
42	.018 In/Sec		
51	.143 In/Sec		
61	.121 In/Sec		
63	.040 In/Sec		
71	.025 In/Sec		
R55-102	- REACTOR AGIT R-102	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	
11	.174 In/Sec	.131 G-s	1760.0 RPM
12	.201 In/Sec	.082 G-s	
13	.187 In/Sec	.097 G-s	
21	.064 In/Sec	.368 G-s	
22	.130 In/Sec	.294 G-s	
23	.114 In/Sec	.168 G-s	
31	.050 In/Sec		
32	.030 In/Sec		
33	.082 In/Sec		
41	.088 In/Sec		
42	.042 In/Sec		
51	.056 In/Sec		
61	.089 In/Sec		
63	.059 In/Sec		
71	.062 In/Sec		
R55-106	- REACTOR AGIT R-106	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	
11	.183 In/Sec	.095 G-s	1760.0 RPM
12	.654 In/Sec	.260 G-s	
13	.482 In/Sec	.103 G-s	
21	.197 In/Sec	.162 G-s	
22	.220 In/Sec	.118 G-s	
23	.461 In/Sec	.393 G-s	
31	.246 In/Sec		
32	.091 In/Sec		
33	.291 In/Sec		
41	.324 In/Sec		
51	.294 In/Sec		
61	.317 In/Sec		
71	.048 In/Sec		
C67-51	- AXIAL TWIN SCREW COMPRESSOR	(27-Sep-21)	
	OVERALL LEVEL	1-20 KHZ	

11	.073 In/Sec	2.729 G-s	1750.0 RPM
12	.063 In/Sec	3.800 G-s	
13	.121 In/Sec	2.257 G-s	
21	.072 In/Sec	1.138 G-s	
22	.089 In/Sec	3.067 G-s	
23	.102 In/Sec	3.955 G-s	
71	.206 In/Sec	.452 G-s	3570.0 RPM
72	.251 In/Sec	.448 G-s	
73	.163 In/Sec	.509 G-s	
81	.157 In/Sec	2.203 G-s	
82	.179 In/Sec	.503 G-s	
83	.232 In/Sec	.536 G-s	
71F	.295 In/Sec	.161 G-s	
72F	.297 In/Sec	.117 G-s	
73F	.205 In/Sec	.730 G-s	
81F	.235 In/Sec	.052 G-s	
82F	.215 In/Sec	.113 G-s	
83F	.316 In/Sec	.370 G-s	

P67-54 - HOT OIL CIRC PMP CENT 15HP (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.144 In/Sec	1.036 G-s	1750.0 RPM
12	.050 In/Sec	.419 G-s	
21	.130 In/Sec	.158 G-s	
22	.028 In/Sec	.272 G-s	
23	.046 In/Sec	.099 G-s	
71	.048 In/Sec	.310 G-s	
72	.040 In/Sec	.417 G-s	
73	.050 In/Sec	.493 G-s	
81	.031 In/Sec	.358 G-s	
82	.031 In/Sec	.141 G-s	

P67-504 - HOT OIL CIRC PMP CENT 50HP (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.222 In/Sec	.293 G-s	1750.0 RPM
12	.083 In/Sec	.195 G-s	
21	.241 In/Sec	.275 G-s	
22	.238 In/Sec	.442 G-s	
23	.184 In/Sec	.188 G-s	
71	.296 In/Sec	.316 G-s	
72	.153 In/Sec	.476 G-s	
73	.213 In/Sec	.300 G-s	
81	.143 In/Sec	.460 G-s	
82	.114 In/Sec	.436 G-s	

R80-10 - AGITATOR GBX (27-Sep-21)

OVERALL LEVEL

11	.108 In/Sec	1760.0 RPM
12	.144 In/Sec	
13	.081 In/Sec	
21	.080 In/Sec	
22	.083 In/Sec	
23	.069 In/Sec	
31	.059 In/Sec	
32	.063 In/Sec	
33	.055 In/Sec	
41	.064 In/Sec	

42	.072 In/Sec
43	.051 In/Sec
51	.093 In/Sec
52	.066 In/Sec
61	.087 In/Sec
62	.048 In/Sec
63	.054 In/Sec

R80-30 - AGITATOR GBX 15HP CHEMINEER (27-Sep-21)

OVERALL LEVEL

11	.162 In/Sec	1760.0 RPM
12	.305 In/Sec	
21	.123 In/Sec	
22	.146 In/Sec	
23	.161 In/Sec	
31	.082 In/Sec	
32	.028 In/Sec	
33	.102 In/Sec	
41	.053 In/Sec	
42	.029 In/Sec	
51	.062 In/Sec	
61	.044 In/Sec	
63	.044 In/Sec	
71	.040 In/Sec	

B82-101A - FAN FORCED DRAFT 10HP SOUTH (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.152 In/Sec	.036 G-s	1800.0 RPM
12	.182 In/Sec	.120 G-s	
* 13	.264 In/Sec	.091 G-s	
21	.141 In/Sec	.144 G-s	
22	.356 In/Sec	.074 G-s	
23	.340 In/Sec	.090 G-s	

B82-102 - INDUCED DRAFT 150 HP (27-Sep-21)

OVERALL LEVEL 1-20 KHZ

11	.032 In/Sec	.089 G-s	1800.0 RPM
12	.034 In/Sec	.090 G-s	
21	.041 In/Sec	.165 G-s	
22	.054 In/Sec	.404 G-s	
23	.041 In/Sec	.141 G-s	
31	.035 In/Sec	.240 G-s	
32	.027 In/Sec	.731 G-s	
41	.030 In/Sec	.070 G-s	
42	.040 In/Sec	.255 G-s	

CHLR45-1 - 20T TRANE CHILLER (27-Sep-21)

OVERALL LEVEL

11W	1.557 In/Sec	3570.0 RPM
12W	.427 In/Sec	
13W	.093 In/Sec	

Clarification Of Vibration Units:

Acc	-->	G-s	PK
Vel	-->	In/Sec	PK

* - Indicates Data Has Date/Time Different From Machine Date/Time