

Taxonomy no 1.3.1		Item	Pumps Centrifugal							
Population	Installations	Aggregated time in service (10 <sup>6</sup> hours)					No of demands  10340			
		Calendar time'			Operational time *					
350	59	13.9546			5.7455					
Failure mode	No of failures	Failure rate (per 10 <sup>6</sup> hours).					Active rep.hrs	Repair (manhours)		
		Lower	Mean	Upper	SD	nit		Min	Mean	Max
Critical	464*	0.00	21.60	124.23	67.21	33.25	39.7	1.0	57.6	1025.0
	464*	0.12	70.52	284.09	106.81	80.76				
Breakdown	37'	0.00	1.20	1.67	7.82	2.65	16.4	3.0	57.1	766.0
	37*	0.00	3.70	21.16	11.38	6.44				
Erratic output	2*	0.00	0.15	0.79	0.54	0.14	19.8	11.0	39.5	68.0
	2*	0.00	0.46	2;22	0.92	0.35				
External leakage - Process	77*	0.00	2.25	5.52	11.84	5.52	30.2	2.0	42.0	444.0
medium	77*	0.00	7.04	38.07	17.67	13.40				
External leakage - Utility medium	46*	0.00	1.61	2.94	9.28	3.30	16.0	2.0	29.8	90.0
	46*	0.00	4.81	26.68	13.65	8.01				
Fail to start on demand	42*	0.01	2.28	8.52	3.14	3.01	55.8	1.0	63.0	551.0
	42*	0.02	13.74	55.88	21.10	7.31				
Fail to stop on demand	2*	0.00	0.13	0.65	0.57	0.14	3.5	3.0	3.5	4.0
	2*	0.00	0.38	1.55	0.58	0.35				
High output	3*	0.00	0.69	3.58	2.77	0.21	-	1.0	3.3	6.0
	3*	0.00	2.49	13.73	6.44	0.52				
Internal leakage	3*	0.00	0.16	0.87	0.57	0.21	188.0	36.0	90.7	188.0
	3*	0.00	0.56	2.63	1.08	0.52				
Low output	40*	0.00	2.58	3.33	17.49	2.87	38.2	3.0	45.3	508.0
	40*	0.00	4.68	7.79	27.92	6.96				
Noise	4*	0.00	0.25	1.29	0.57	0.29	25.0	16.0	67.3	122.0

	4*	0.03	0.78	2.34	0.80	0.70					
Other	8'	0.00	0.60	3.20	2.68	0.57	275.5	2.0	424.5	734.0	
	8*	0.00	1.85	8.07	3.14	1.39					
Overheating	5*	0.11	0.36	0.72	0.19	0.36	183.2	3.0	265.0	1025.0	
	5*	0.00	6.83	37.16	17.32	0.87					
Parameter deviation	16*	0.00	0.65	2.84	3.03	1.15	11.6	1.0	21.7	88.0	
	16*	0.15	2.58	7.60	2.53	2.78					
Spurious stop	120*	0.00	6.33	33.92	15.65	8.60	39.7	1.0	45.0	714.0	
	120*	0.51	22.56	69.52	24.44	20.89					
Structural deficiency	27*	0.00	0.61	0.72	6.77	1.93	23.9	7.0	47.3	211.0	
	27*	0.00	1.77	3.32	10.06	4.70					
Vibration	32*	0.00	2.12	10.93	4.76	2.29	81.2	5.0	118.3	896.0	
	32*	0.62	6.76	18.55	6.00	5.57					
Degraded	537*	0.00	32.39	163.45	70.23	38.48	22.3	0.5	32.1	798.0	
	537*	3.74	237.30	747.95	267.91	93.46					
Abnormal instrument reading	9*		0.85	4.95	2.70	0.64	9.0			65.0	
		0.00						2.0	16.0		
	9*	0.00	2.95	12.59	4.86	1.57					
Erratic output	10*	0.00	1.95	10.27	6.99	0.72	20.3	2.0	17.4	65.0	
	10*	0.00	4.87	26.99	13.79	1.74					
Comments											(cont)

Taxonomy no 1.3.1		Item Machinery Pumps Centrifugal								
Population	Installations	Aggregated time in service (10 <sup>6</sup> hours)					No of demands			
350	59	Calendar time *			Operational time *		10340			

		13.9546			5.7455					
Failure mode	No of	Failure rate (per 10 <sup>6</sup> hours).					Active rep.hrs	Repair (manhours)		
	failures	Lower	Mean	Upper	SD	nit		Min	Mean	Max
External leakage - Process	56'	0.00	3.25	18.02	9.21	4.01	14.1	2.0	31.7	278.0
medium	56*	0.02	10.52	41.84	15.63	9.75				
External leakage - Utility medium	178*	0.00	9.26	45.08	18.79	12.76	30.2	1.0	36.3	219.0
	178*	0.00	57.14	265.19	107.20	30.98				
Fail to stop on demand	3*	0.00	0.30	1.59	1.11	0.21	3.8	6.0	7.7	10.0
	3*	0.00	9.30	43.28	17.53	0.52				
High output	T	0.00	0.07	0.20	0.07	0.07	2.0	2.0	2.0	2.0
	1*	0.00	0.15	0.48	0.17	0.17				
Internal leakage	11*	0.00	0.87	4.75	2.22	0.79	56.8	2.0	56.0	304.0
	11*	0.00	6.17	34.28	17.67	1.91				
Low output	30*	1.32	2.15	3.15	0.56	2.15	8.4	0.5	14.4	144.0
	30*	4.96	37.34	94.91	29.45	5.22				
Minor in-service problems	3*	0.00	0.29	1.61	0.83	0.21	13.0	18.0	22.0	26.0
	3*	0.00	9.27	43.11	17.46	0.52				
Noise	5*	0.00	0.32	1.72	1.08	0.36	17.7	6.0	35.3	75.0
	5*	0.00	0.95	4.61	1.91	0.87				
Other	46*	0.00	4.29	21.19	8.96	3.30	18.5	1.0	21.8	165.0
	46*	0.00	27.99	132.88	54.47	8.01				
Overheating	9*	0.00	0.83	4.58	2.14	0.64	45.6	7.0	66.0	112.0
	9*	0.00	6.15	34.20	17.71	1.57				
Parameter deviation	70*	0.00	2.60	3.48	17.29	5.02	4.5	1.0	7.3	67.0
	70*	0.00	5.71	19.81	27.67	12.18				
Structural deficiency	61*	0.00	1.73	1.92	13.81	4.37	26.9	1.0	33.9	798.0
	61*	0.00	5.75	20.30	27.74	10.62				
Vibration	45*	0.00	2.89	16.73	9.18	3.22	34.2	1.0	78.1	737.0

	45*	0.00	8.58	37.96	14.93	7.83				
Incipient	936*	0.00	56.57	262.99	106.45	67.07	10.8	0.5	15.6	697.0
	936*		95.49	834.30	2182.80	686.83	162.91			
Abnormal instrument reading										
	445*	0.00	25.76	128.63	54.90	31.89	5.7	0.5	8.1	144.0
	445*	4.46	274.18	862.22	308.37	77.45				
Erratic output	5*	0.00	0.39	2.04	1.41	0.36	4.1	2.0	8.2	16.0
	5*	0.00	1.36	5.38		2.01	0.87			
External leakage - Process medium	46*	0.00	2.73	14.38	9.89	3.30	15.3	0.5	24.4	206.0
	46*	0.00	8.60	44.48	19.52		8.01			
External leakage - Utility medium	108*	0.00	5.29	28.69	13.34	7.74	23.5	1.0	28.0	179.0
	108*	0.57	17.63	53.47	18.40		18.80			
Internal leakage	9'	0.00	0.45	2.09	0.84	0.64	42.6	0.5	41.2	172.0
	9*	0.28	1.42	3.27	0.96	1.57				
Low output	r	0.00	0.06	0.33	0.15	0.07	2.0	2.0	2.0	2.0
	1*	0.00	0.18	0.55	0.20	0.17				
Comments (cont.)										

Taxonomy no 1.3.1		Item Machinery Pumps Centrifugal									
Population 350	Installations 59	Aggregated time in service (10 <sup>6</sup> hours)					No of demands 10340				
		Calendar time * 13.9546			Operational time * 5.7455						
Failure mode		No of failures	Failure rate (per 10 <sup>6</sup> hours).					Active rep.hrs	Repair (manhours)		
			Lower	Mean	Upper	SD	n/t		Min	Mean	Max
Minor in-service problems		213*	0.00	15.38	80.97	36.69	15.26	6.1	0.5	10.4	111.0
		213*	39.27	391.65	1057.33	338.88	37.07				
Noise		8'	0.00	0.64	3.23	1.39	0.57	7.3	0.5	20.1	46.0

		8*	0.04	2.12	6.58	2.32	1.39				
Other	47*		0.00	3.14	17.24	8.40	3.37	27.3	1.0	46.0	697.0
	47*	0.00		20.65	103.50	44.28	8.18				
Overheating	4*	0.00		0.23	0.95	1.08	0.29	30.3	3.0	34.3	64.0
	4*	0.00		0.67	2.83	1.09	0.70				
Parameter deviation	23*	0.00		1.08	5.59	4.15	1.65	9.3	2.0	14.1	81.0
	23*	0.02		3.82	13.98	5.17	4.00				
Structural deficiency	12*		0.00	0.79	4.43		2.30	42.1	1.0	70.0	213.5
	12*	1.32		2.21	3.28	0.60	2.09				
Unknown	4*	0.00		0.41	0.74	2.34	0.29	45.3	8.0	38.5	70.0
	4*	0.00		1.48	8.16	4.96	0.70				
Vibration	ir	0.00		0.78	3.33	1.28	0.79	9.9	1.0	26.7	96.0
	n*	0.01		2.48	9.16	3.38	1.91				
Unknown	12*	0.00		1.17	6.41	3.08	0.86	6.8	2.0	13.6	48.0
	12*	0.01		4.50	17.83	6.65	2.09				
External leakage - Utility medium	r	0.00		0.21	0.59		1.05	-	29.0	29.0	29.0
	1*	0.00		0.84	4.67	2.38	0.17				
Other	2*	0.01		0.15	0.43	0.14	0.14		12.0	12.0	12.0
	2*	0.00		0.60	3.14	1.42	0.35				
Unknown	9*	0.00		0.82	4.48	2.79	0.64	6.8	2.0	12.1	48.0
	9*	0.00		3.20	15.07	6.15	1.57				
All modes	1949*	0.00		112.64	546.74	226.89	139.67	21.3	0.5	30.5	1025.0
	1949*		172.90	1277.00	3233.73	1001.75	339.22				
Comments On demand probability for consequence class: Critical and failure mode: Fail to start on demand = 1.31 O <sup>3</sup>											