KelairPumps

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PumpAction ..... Issue 27

Welcome to the 27th edition of Pump Action.

Kelair's Building & Fire Division was strengthened last year when the company acquired Rob Laine Pumping Solutions Pty Ltd. Based in Melbourne, Rob Laine has been providing products to the Building & Fire industry since 1983.

The company specialises in the design, manufacture and servicing of packaged pump sets for the Fire, Mechanical Services and Hydraulic/Plumbing markets and builds fire pump sets to both AS2941 and NFPA Factory Mutual.

Rob Laine operates a commercial pump test rig facility with a flow capacity up to 300 l/s and is able to test to AS2417, BS5310 and ISO9906 and is approved for testing to the exacting requirements of international authorities including Lloyds Register, Det Norske Veritas and Germanischer Lloyds.

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CASE STUDY

Rob Laine setting a hot pace for fire pump sets

Rob Laine Pumping Solutions (based in Melbourne), a division of Kelair Pumps, has seen an increase in demand for packaged fire pump sets.

Some of the reasons for this are the high cost of on-site labour and short installation times required.

Rob Laine's engineers can tailor the units (built to AS2941, American NPA20, or factory mutual) to suit individual site requirements which can include pressure relief, test line, circulation relief and heat exchanger waste plumbed to edge of the base.

Valve monitors and pressure gauges can also be incorporated. Single or double pressure switch test loop can be wired and plumbed, as well as the jacking pump.

Packaged fire pump set built by Rob Laine for Leemark Fire Protection. (Pump duty 5,500 l/m @ 500 kPa, Southern Cross ISO125-250, Cummins 4BT 75 kW @ 2600 rpm).

• For further Rob Laine product information call 03 9706 6505

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CASE STUDY

Kelair's Viking pumps ease pressure for AMS

Kelair Pumps was contacted by Australian Mining Services (AMS) to solve a problem it was having on a bitumen spraying unit. The unit was designed to spray a thin film of bitumen solution for dust supression of road-ways and traffic areas in underground coal mines.

The problem was that the originally fitted centrifugal pumps could not develop enough pressure to achieve an acceptable spray pattern through the machine's spraying nozzles. The centrifugal pump also had fine internal passages that tended to block, thus reducing flow.

AMS discussed pumping options with Kelair's Sales Engineer, Myro Bratkovic and it was re-solved the best option would be to use a positive displacement-style pump that would achieve continuous pressure and an even spraying pattern.

The option Myro selected, based on local knowledge and the vast international experience of Viking in pumping Bitumen, was a Viking KK4124A Universal Bracket Series pump,

A bonus to selecting the Viking pump was that it was compact enough to fit on the machine with minor modification (the new pump could not be larger that the unit it was replacing) and is a stock model.

Since the first pump was fitted, another 3 Viking pumps were purchased by AMS to be retro-fitted to other identical machines.

The Viking pumps have now been in service for some 12 months.

• For further Viking product information visit our website www.kelairpumps.com.au

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PUMP CLINIC 1

Centrifugal Troubleshooting

TABLE 1 - IDENTIFICATION CHART

	SYMPTOMS	POSSIBLE CAUSES (See definitions Table 2)
1.	Pump does not deliver liquid	1/2/3/510/12/13/14/16/21/22/25/30/32/38/40
2.	Insufficient capacity delivered	2/3/4/5/6/7/7a/10/11/12/13/14/15/16/17/18/21/22/ 23/24/25/31/32/40/41/44/63/64
3.	Insufficient pressure developed	4/6/7/7a/10/11/12/13/14/15/16/18/21/22/23/24/25/ 34/39/40/41/44/63/64
4.	Pump loses prime after starting	2/4/6/7/7a/8/9/10/11
5.	Pump requires excessive power	20/22/23/24/26/32/33/34/35/39/40/41/44/45/61/69/ 70/71
6.	Pump vibrates or is noisy at *all* flows	2/16/37/43/44/45/46/47/48/49/50/51/52/53/54/55/ 56/57/58/59/60/61/67/78/79/80/81/82/83/84/85
7.	Pump vibrates or is noisy at *low* flows	2/3/17/19/27/28/29/35/38/77
8.	Pump vibrates or is noisy at *high* flows	2/3/10/11/12/13/14/15/16/17/18/33/34/41
9.	Shaft oscillates axially	17/18/19/27/29/35/38
10.	Impeller vanes are eroded on *visible* side	3/12/13/14/15/17/41
11.	Impeller vanes are eroded on *invisible* side	12/17/19/29
12.	Impeller vanes are eroded at discharge near centre	37
13.	Impeller vanes are eroded at discharge near shrouds or at shroud/vane fillets	27/29
14.	Impeller shrouds bowed out or fractured	27/29
15.	Pump overheats and seizes	1/3/12/28/29/38/42/43/45/50/51/52/53/54/55/57/58 /59/60/61/62/77/78/82
16.	Internal parts are corroded prematurely	66
17.	Internal clearances wear too rapidly	3/28/29/45/50/51/52/53/54/55/57/59/61/62/66/77
18.	Axially split casing is cut through wire-drawing	63/64/65
19.	Internal stationary joints are cut through wire-drawing	53/63/64/65
20.	Packed box leaks excessively or packing has short life	8/9/45/54/55/57/68/69/70/71/72/73/74
21.	Packed box sleeve is scored	8/9
22.	Mechanical seal leaks excessively	45/54/55/57/58/62/75/76
23.	Mechanical seal has damaged faces, sleeve bellows	45/54/55/57/58/62/75/76
24.	Bearings have short life	3/29/41/42/45/50/51/54/55/58/77/78/79/80/81/82/ 83/84/85
25.	Coupling fails	45/50/51/54/67

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TABLE 2 - DEFINITIONS

Suction Troubles

1. Pump not primed
2. Pump suction pipe not completely filled with liquid
3. Insufficient available NPSH
4. Excessive amount of air of gas in liquid
5. Air pocket in suction line
6. Air leaks into suction line
7. Air leaks into pump through stuffing boxes or through mechanical seal

7a. Air in source of sealing liquid

8. Water seal pipe plugged
9. Seal cage improperly mounted in stuffing box
10. Inlet of suction pipe insufficiently submerged
11. Vortex formation at suction
12. Pump operated with closed or partially closed suction valve
13. Clogged suction strainer
14. Obstruction in suction line
15. Excessive friction losses in suction line
16. Clogged impeller
17. Suction elbow in plane parallel to the shaft (for double-suction pumps)
18. Two elbows in suction piping at 90º to each other, creating swirl and pre-rotation
19. Selection of pump with too high a suction specific speed

Other Hydraulic Problems

20. Speed of pump too high
21. Speed of pump too low
22. Wrong direction of rotation
23. Reverse mounting of double-suction impeller
24. Uncalibrated instruments
25. Impeller diameter smaller than specified
26. Impeller diameter larger than specified
27. Impeller selection with abnormally high head coefficient
28. Running the pump against a closed discharge valve without opening a bypass
29. Operating pump below recommended minimum flow
30. Static head higher than shut-off head
31. Friction losses in discharge higher than calculated
32. Total head of system higher than design of pump
33. Total head of system lower than design of pump
34. Running of pump at too high a flow (for low specific speed pumps)
35. Running pump at too low a flow (for high specific speed pumps)
36. ----
37. Too close a gap between impeller vanes and volute tongue or diffuser vanes
38. Parallel operation of pumps unsuitable for the purpose
39. Specific gravity of liquid differs from design conditions
40. Viscosity of liquid differs from design conditions
41. Excessive wear at internal running clearances
42. Obstruction in balancing device leak-off line
43. Transients at suction source (imbalance between pressure at surface of liquid and vapour pressure at suction flange)

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Mechanical Troubles - General

44. Foreign matter in impellers
45. Misalignment
46. Foundation insufficiently rigid
47. Loose foundation bolts
48. Loose pump or motor bolts
49. Inadequate grouting of baseplate
50. Excessive piping forces and movements on pump nozzles
51. Improperly mounted expansion joints
52. Starting the pump without proper warm-up
53. Mounting surfaces of internal fits (at wearing rings, impellers, shaft sleeves, shaft nuts, bearing housings, etc) not perpendicular to shaft axis
54. Bent shaft
55. Rotor out of balance
56. Parts loose on the shaft
57. Shaft running off-centre because of worn bearings
58. Pump running at or near critical speed
59. Too long a shaft span or too small a shaft diameter
60. Resonance between operating speed and natural frequency of foundation, baseplate or piping
61. Rotating part rubbing on stationary part
62. Incursion of hard solid particles into running clearances
63. Improper casing gasket material
64. Inadequate installation of gasket
65. Inadequate tightening of casing bolts
66. Pump materials not suitable for liquid handled
67. Certain couplings lack lubrication

Mechanical Troubles - Sealing Area

68. Shaft or sleeves worn or scored at packing
69. Incorrect type of packing for operating conditions
70. Packing improperly installed
71. Gland too tight, prevents flow of liquid to lubricate packing
72. Excessive clearance at bottom of stuffing box allows packing to be forced into pump interior
73. Dirt or grit in sealing liquid
74. Failure to provide adequate cooling liquid to water-cooled stuffing boxes
75. Incorrect type of mechanical seal for prevailing conditions
76. Mechanical seal improperly installed

Mechanical Troubles - Bearings

77. Excessive radial thrust in single-volute pumps
78. Excessive axial thrust caused by excessive wear at internal clearances or by failure or, if used, excessive wear of balancing device
79. Wrong grade of grease or oil
80. Excessive grease or oil in anti-friction bearing houses
81. Lack of lubrication
82. Improper installation of anti-friction bearings such as damage during installation, incorrect assembly of stacked bearings, use of unmatched bearings as a pair, etc
83. Dirt getting into bearings
84. Moisture contaminating lubricant
85. Excessive cooling of water-cooled bearings

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TABLE 3 - DIAGNOSIS FROM APPEARANCE OF STUFFING BOX PACKING

SYMPTOMS	CAUSES
▪ Wear on one or two rings next to packing gland (other rings OK)	Improper packing installation
▪ Wear on outside diameter of packing rings	Packing rings rotating with shaft sleeve or leakage between rings and inside diameter of box. Wrong packing size or incorrectly cut rings
▪ Charring or glazing of inner circumference of rings	Excessive heating. Insufficient leakage to lubricate packing or unsuitable packing
▪ Inside diameter of rings excessively increased or heavily worn on part of inner circumference	Rotation eccentric

TABLE 4 - VIBRATION

VIBRATION FREQUENCY	CAUSES
▪ Several times pump r/min	Bad anti-friction bearings
▪ Twice pump r/min	Loose parts on rotor, axial misalignment of coupling, influence of twin-volute when gap is insufficient
▪ Running speed	Imbalance of rotor, clogged impeller, coupling misalignment
▪ Running speed times number of impeller vanes	Vane passing syndrome – insufficient gap between impeller vanes and collector vanes. This is also sometimes seen during operation with suction recirculation
▪ One-half running speed	Oil whirl in bearing
▪ Random low frequency	Internal recirculation in impeller or cavitation
▪ Random high frequency	Usually resonance
▪ Sub synchronous frequency at 70% to 90%	Hydraulic excitation of resonance