ANTI-SWAY SYSTEM
FOR CONTAINER YARD CRANE &
T-L-S – ANTISNAG SYSTEMS

RIMA S.R.L.
DATA SHEET “ANTISWAY SYSTEMS”

SYSTEM PERFORMANCES

Trim, Skew
It allows the rotation of the spreader around the longitudinal and the vertical axes of the head-block. It is operated through two double rod hydraulic cylinders controlled by the hydraulic unit.

Anti-Sway
It allows the damping of head-block, spreader and container oscillation generated by acceleration/deceleration of trolley and gantry. It is achieved by four winches with ropes crossconnected to the head block, which provide the forces required to damp the spreader/container oscillations. The reactive force given by ropes released by two winches during a semi-oscillation, is much bigger than the force applied to ropes reeled up by the two opposite winches at same time. The difference between horizontal components respectively of the ropes pulling reactive forces and the rope reeling up forces produces the oscillation damping.
To adapt the damping action to several load conditions (loaded/unloaded spreader), the damping force above defined, is properly regulated/adjusted through suitable control.
The anti-sway function is controlled by a suitable hydraulic control unit (controlling also Trim Skew function).

INDICATIVE GENERAL INFORMATION

Anti-sway ropes pulling reactive force. Adjustable from 250 to 1500 daN
Anti-sway ropes reeling force. 200 daN

CRANE MAIN DATA
(values indicated here below have to be intended as an example; damping diagrams shown in this catalogue are referred to present values)
SYSTEM PERFORMANCES

No. 1 Hydraulic unit composed by:
Tank made with suitable thickness welded carbon steel plate, capacity approx. 600 dm³, internal surface painted with suitable paint, provided with inspection door, filling up plug with breather filter, drain ball valve with closing plug, level and temperature oil indicators, oil heaters if needed, heat exchanger.

Controls:
- Thermostat max oil temperature
- Thermostat to control the oil heater
- Thermostat to control the heat exchanger
- Thermostat min. oil temperature for working consent
- Oil level switch
- Electric indicator of filter obstructed

Three-phase, electric motor according to UNEL - MEC. Power (indicative) 15 kW - 400 V 50Hz, 4 poles protection IP55, marine environment, aluminium framework. With heater. Form V1. The hydraulic unit is supplied with steel protection provided with hinged inspection doors.

All the electrical users, apart from the electric motor, are wired to a connection box installed on the hydraulic unit. In the same connection box can be located the electronic card for the control of anti-sway damping force.

No.2 Double effect and double rod hydraulic cylinders for trim-skew (Indicative data).

Rods in carbon steel NIKROM (or stainless steel). Over centre valves directly installed on the cylinders.

No. 4 Winches, each one composed by:
Stiff frame in carbon steel, with grooved drum, rope anti-derailment system, suitable for rope D = 14 mm.

- Hydraulic motors.
- Epicyclical gear reducer.
- Rope nominal max force: 1500 daN
DATA SHEET “ANTI-SWAY SYSTEM FOR CONTAINER YARD CRANE”

PENDOLAZIONI DOPO FRENATA DEL CARRELLO - PENDULAR MOVEMENT AFTER TROLLEY BRAKING

DATI CARATTERISTICI
- Velocità iniziale: 1.17 m/s
- Decelerazione: 0.3 m/s²
- Altezza pendolazione: 12m

LEGENDA
- Velocità
- Pendolazione senza Antisway
- Pendolazione con Antisway

DATA
- Starting speed: 1.17 m/s
- Deceleration: 0.3 m/s²
- Pendular mov. amplitude: 12m

LEGEND
- Speed
- Pendular movement without Antisway
- Pendular movement with Antisway
**PENDOLAZIONI DOPO FRENATA DEL CAVALETTO - PENDULAR MOVEMENT AFTER GANTRY BRAKING**

**DATI CARATTERISTICI**

- Velocità iniziale: 2.17 m/s
- Decelerazione: 0.21 m/s²
- Altezza pendolazione: 12m

**LEGENDA**

- Green: Speed
- Red: Pendular movement without Antisway
- Blue: Pendular movement with Antisway

**DATA**

- Starting speed: 2.17 m/s
- Deceleration: 0.21 m/s²
- Pendular mov. amplitude: 12m

**LEGEND**

- Green: Speed
- Red: Pendular movement without Antisway
- Blue: Pendular movement with Antisway
NEVER WORRY ABOUT SNAG WITH RIMA ANTI SNAG SYSTEM

Equipment description
The equipment is made with nr 4 suitable cylinders that act on the fixed point (or on return pulleys) of hoist ropes of spreader. The possible arrangements are indicated in fig land 2.
The double acting cylinders usually work in median position, so as they can pull or release the ropes. These cylinders carry out the following spreader positioning functions:

TRIM = trimming around the horizontal transverse axis
LIST = listing around the horizontal longitudinal axis
SKEW = skewing around the vertical axis

These functions are obtained by acting on the cylinder two by two. Two cylinders pull while other two release the ropes. Changing the cylinder combination the three movements are obtained. The cylinders move themselves in a synchronous way during each phase.

In addition to this function, the same cylinders have the antisnag function. It means they absorb the possible bumps of spreader into hold of ship owing to wrong manoeuvres.
In this situation the cylinders work as a hydraulic shock absorber of the bump energy by expulsion of pressurised oil through a calibrated relief valve that is assembled directly on the cylinders.

DATA OF PLANT
(The plant is composed of:
N. 1 Hydraulic package with pump group and control valves
N. 4 Hydraulic cylinders with chromed inox piston rods or niched and chromed piston rods with linear position transducers.
Relief valves and antisnag valves are directly connected to cylinders.)
**TEST REPORT**

**About Antisnag valve / Über die Prüfung von Antisnagsventill / Prove condotte su valvola antisnag**

<table>
<thead>
<tr>
<th>Customer/Auftraggeber</th>
<th>RIMA s.r.l.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Via E. Fermi, 255</td>
</tr>
<tr>
<td></td>
<td>21042 Caronno Pertusella (VA)</td>
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<table>
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<th>Producer/Hersteller</th>
<th>RIMA s.r.l.</th>
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<td>21042 Caronno Pertusella (VA)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective/Prüfgegenstand</th>
<th>Antisnag valve / Antisnagsventill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Valvola antisnag</td>
</tr>
</tbody>
</table>

| Date/Datum | 01/10/01          |
| No. of order/Auftragsnummer | 116295          |
| Data target/Durchführung der Versuche | RIMA workshop, bei dem Werkstatt des Herstellers presso l’officina del costruttore |
| Date of test/Datum der Durchführung der Versuche | 06/09/01 |

**Documentation/Prüfunterlagen**

Drawings/Zeichnungen Nr.: Fig. 1, Fig. 2, SCI 9000-500 vom 05/06/01.

Graphic Antisnag test,
Rapporto di taratura 3.1.8 Wika 0436-01
Test description/Prüfumfang/Descrizione delle verifiche

See attachment „Antisnag test”
Siehe Anlage „Antisnag test”
Vedere allegato „Antisnag test”

Test results/Ergebnis der Versuche/Esito delle prove

<table>
<thead>
<tr>
<th>Calibration pressure</th>
<th>Initial flow</th>
<th>Max pressure</th>
<th>Opening time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kalibr. Druck</td>
<td>Durchfluss</td>
<td>Max Druck</td>
<td>Öffnungszelt</td>
</tr>
<tr>
<td>Pressione di</td>
<td>Flusso iniziale</td>
<td>Pressione massima</td>
<td>Tempo di apertura</td>
</tr>
<tr>
<td>calibrazione</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>170 bar</td>
<td>1900 l/min</td>
<td>310 bar</td>
<td>4.3 m/s</td>
</tr>
</tbody>
</table>

See attached diagrams
Siehe Anlagen
Vedi diagrammi in allegato

Conclusions/Prüfergebnis/Conclusioni

The use of the antisnag valve is admitted, since it has met the above tests conditions.
Gegen einen bestimmungsgemäßen Einsatz des Antisnagventils bestehen unsererseits keine Bedenken.
Contro un uso della valvola antisnag, risultato conforme alle prove in oggetto, non viene posto da parte nostra alcun vincolo.

Ing. Dario Marconi
Responsabile Sicurezza

The „Antisnag Test“ report is essential part of this report and only integral copies of it are admitted.
Diesen Prüfbericht legt der Bericht „Antisnag Test“ zugrunde.
Il rapporto „Antisnag Test“ è parte integrante di questo report.
Questo rapporto può essere riprodotto solo integralmente.
TYPICAL DATA GRU
(valid for cylinders put on the fixed end of ropes)

POSSIBLE EXECUTIONS
Hydraulic Unit:
- Open
- Closed with cover
- Closed with hinged doors
- Closed-packed execution in which the cylinders are already connected to hydraulic unit and ready to work

Speed:
- Fixed
- Double
- Adjustable continuously (with or without feed back retroaction)

Pump:
- Single with fixed flow
- Single with variable flow
- Double (one for stand-by) with variable flow

Antisnag valves:
- With loss: they are more ready if snag happens but a continuously position check is required
- Without loss

OPERATING
TLS movement:
They are driven by operator. The stroke indicators assembled inside the cylinders act as reference for stop position of cylinders. The movement speed can be fixed or variable according to required solution. It is possible to memorise and to find again automatically some positions of stability by stroke indicators.

Antisnag movement:
If the spreader bumps into hold of ship or into other obstacle, the pressure into cylinder increases. When pressure value exceeds a settled value (usually 25% more than max working value) the antisnag valve opens itself very quickly (opening time as not to be major than 50 mms) allowing oil to flow in pressure and bump energy to be absorbed. At the same time suitable load cells stop the lifting motor.
- Cylinder: \( \phi 70, \phi 40 \), stroke 500;
- Weight: 497 kg;
- Pressure relief valve setting: 170 bar;

**CONVERSION TENSION (V) TO PRESSURE**

Pressure (bar) = Tension (V) * 40

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**Measurement Method**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
<th>Automatic</th>
<th>Units</th>
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<tbody>
<tr>
<td>Frequency</td>
<td>541.68 Hz</td>
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<td>Hz</td>
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<tr>
<td>Pos. Pulse Width</td>
<td>954.03 us</td>
<td></td>
<td>S</td>
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<tr>
<td>Neg. Pulse Width</td>
<td>892.06 us</td>
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<td>S</td>
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<tr>
<td>Rise Time</td>
<td>736.67 us</td>
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<td>S</td>
</tr>
<tr>
<td>Fall Time</td>
<td>786.30 us</td>
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<td>S</td>
</tr>
<tr>
<td>Pos. Duty Cycle</td>
<td>516.78 ms</td>
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<td>S</td>
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<tr>
<td>Neg. Duty Cycle</td>
<td>483.22 ms</td>
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<tr>
<td>Pos. Overshoot</td>
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<td>S</td>
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<tr>
<td>Neg. Overshoot</td>
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<td>S</td>
</tr>
<tr>
<td>Peak to Peak</td>
<td>7.9200 V</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Amplitude</td>
<td>7.9200 V</td>
<td></td>
<td>V</td>
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<tr>
<td>High</td>
<td>7.7600 V</td>
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<td>V</td>
</tr>
<tr>
<td>Low</td>
<td>-160.00 mV</td>
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<td>V</td>
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<tr>
<td>Maximum</td>
<td>7.7600 V</td>
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<td>Minimum</td>
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<tr>
<td>Mean</td>
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<tr>
<td>Cycle Mean</td>
<td>3.7862 V</td>
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<td>RMS</td>
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<td>BurstWidth</td>
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<td>CEnergys</td>
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<tr>
<td>ACRMS</td>
<td>1.6775 V</td>
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</tr>
<tr>
<td>CRM</td>
<td>4.5703 V</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>
- Cylinder ø70, ø40, stroke 500;
- Weight 497 kg;
- Pressure relief valve setting
  - A = 0 mS (Initial time); 170 bar;
  - B = 4.3 mS (Opening time);
- Cylinder ø70, ø40, stroke 500;
- Weight 497 kg;
- A = 0 V – 0 bar (Precharge system);
- B = 4.25 V – 170 bar (Pressure relief valve setting);
- C = 7.76 V – 310 bar (Maximum pressure);