Ente Nazionale
Meccanizzazione Agricola

AGRICULTURAL MACHINERY FUNCTIONAL
AND SAFETY TESTING SERVICE

TEST REPORT No. 40b - 006

"OGRI 2003" SELF-LOCKING LOWER HOOK
FOR AGRICULTURAL MACHINERY LIFT SYSTEMS

MANUFACTURER:
AMA S.P.A. – (ISI DIVISION)
VIA PUCCINI, 28 – 42018 S. MARTINO IN RIO (RE)

November 2005

TESTS CARRIED OUT IN COMPLIANCE WITH ENAMA SPECIFICATIONS NO. 40B BY COUNCIL FOR AGRICULTURAL RESEARCH AND EXPERIMENTATION - EXPERIMENTAL INSTITUTE FOR AGRICULTURAL MECHANISATION, TREVIGLIO (BG):

- Supervisor: Dott. Agr. Carlo Bisaglia
  Dott. Ing. Giuliano Gruppo

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MANUFACTURER:
AMA S.P.A. – ISI DIVISION
Tel. 0522 636911 – Fax. 0522 695753
email: isi@isisrl.com internet: isi@isisrl.com

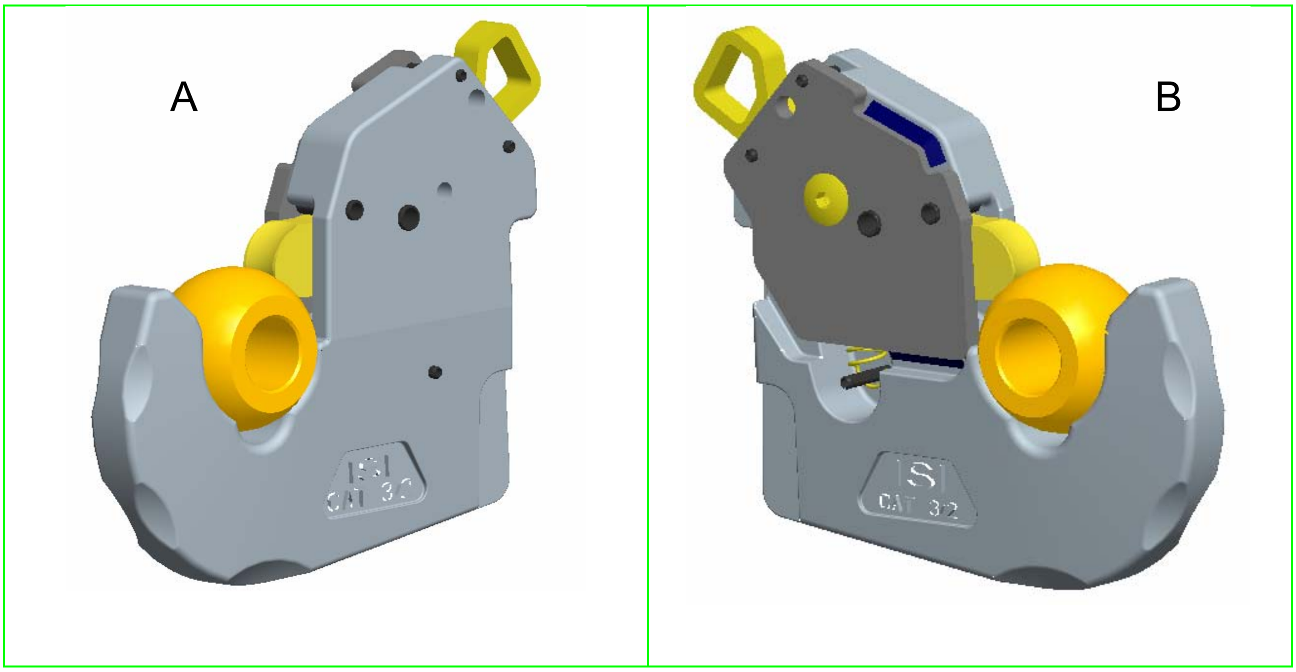

Fig. 1 – Side views of the AMA OGRI 2003 self-locking lower hook.
A) left side; B) right side.

TECHNICAL DESCRIPTION

The present test report refers to the lower hooks for the quick coupling of trailed or semi-trailed agricultural implements to the hydraulic lift of a tractor. The hooks have been designed and constructed by the AMA SpA Group (ISI Division), based in S. Martino in Rio (RE), proposed as an alternative to self-locking systems already on the market, preserving existing functionality while offering new construction solutions and clear advantages in terms of ease of use and ergonomic factors.
The construction properties (materials and dimensions) of the AMA (ISI Division) hooks under review allow them to be applied to 3-point hitch elements in compliance with the standards of the relative category (ISO II) without having to modify in any way existing shapes and operating capacity. In construction terms the lower hook consists of one fixed part and some moving parts. The fixed part, called the “body”, is made of hot-pressed steel (36 CrMn 5) hardened and tempered by induction in the ball joint contact zone. The resulting piece is further treated via the removal of chips to shape the surface to be compatible with the ball joint for the trailer hitch and with the seat of the shutter for the opening and closing of the hook. Fig. 1 shows that the hook’s body is made from a single block, while active closure parts are subsequently mounted and kept in position via a plate welded to the body in the final phase of manufacturing (in figure 1 B the closing plate is in the darkest grey tone). Fig. 2 gives a complete view of the parts making up the tested hook, with an exploded diagram of model OGRI 2003. See the shutter (6) and the relative manually operated opening wing nut (5), connected via a metal pin (4); also visible are the return springs for quick coupling (8 and 10) and the plate on which the whole kinematic system is supported (12).
Stop pins (2-3 and 11) serve as a reference for the correct mounting of the plate on the body; stop pin (7) serves to limit the shutter opening stroke, while stop pin (9) serves to withstand forced and/or accidental openings of the hook; for the tested hook the stop pin consisted of two parts, one placed inside the other, to ensure greater resistance.

The hook appears compact and adequately protected against the entry of dirt during work; there are however some spaces that allow periodical cleaning in order to maintain the reliability of the part.
The hook is opened simply by pulling the wing nut towards the outside of the body.

The hook can be kept in an open position thanks to an ad hoc groove made on the upper edge of the wing nut body, which can be hooked to one of the stop pins used to position the plate.

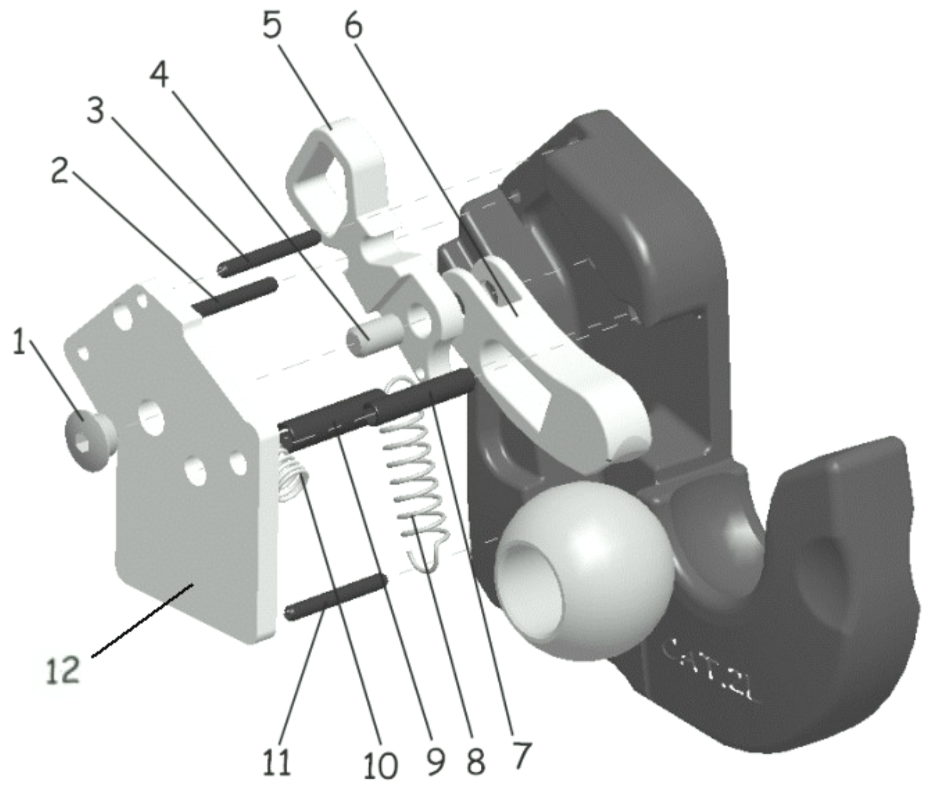

Fig. 2 – Exploded diagram of the self-locking lower hook. The following parts may be seen: 1) protective plug; 2, 3, 11, reference pins for correct mounting of protective plate; 4) base pin of the closure mechanism; 5) wing nut for manual opening; 6) shutter; 7) stop pin for opening of shutter; 8) return spring of opening wing nut; 9) stop pin to prevent accidental release; 10) return spring of shutter; 12) protective plate welded to hook’s body.

DIMENSIONS

The tested hooks were mounted on link arms and connected to the top link in order to create a complete, category ISO II three-point linkage.

The size and shape characteristics, with reference to Fig. 3, are given in Tab. 1. The ball joints had an external diameter of 56 mm.

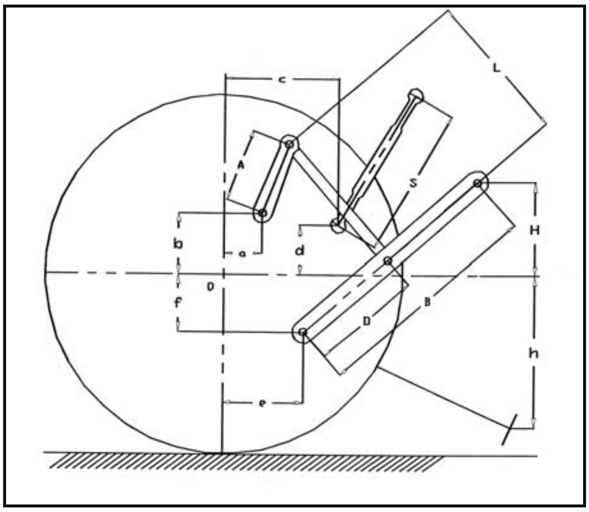

Fig. 3 – Diagram showing parts of 3-point hitch created for tests.

Length of top link (S)	735 mm
Connection of tie rod (D)	445 mm
Length of lower arm (B)	775 mm
Distance of upper arms	720 mm
Coupling distance of lower arms	620 mm
Length of tie rod (L)	535 mm

Tab. 1 – Size characteristics of 3-point hitch created for tests.

FUNCTIONALITY TESTS

Functionality tests were based on ascertaining whether the device in question could adequately perform the task asked of it. In the case in point, it was ascertained whether hooks could ensure the quick coupling of the implement to the tractor after the latter had been adequately positioned, without breakage or accidental release upon the application of variously oriented forces on the vertical plane (static tests).

Equipment used

Tests were performed on a specially prepared universal test bench (Fig. 4), capable of simulating the rear part of a tractor. The two hooks were installed on the bench, complete with arms, and a top link arm sized to make up a complete category ISO II coupling. The arms were amounted horizontally, while the linkage was adjusted as usual, through vertical tie rods and horizontal stabilisers, both of which adjustable. A triangular frame with ball joints at the tips of the lower horizontal side, kept the three-point hitch in position, simulating the presence of an implement.

Fig. 4 – Test bench used for the strength test for lower automatic hooks for hydraulic lifts

Both of the two hooks were put under stress, in the area of the ball joints, by a pair of jacks, one vertical and the other horizontal, as illustrated in Fig. 5.

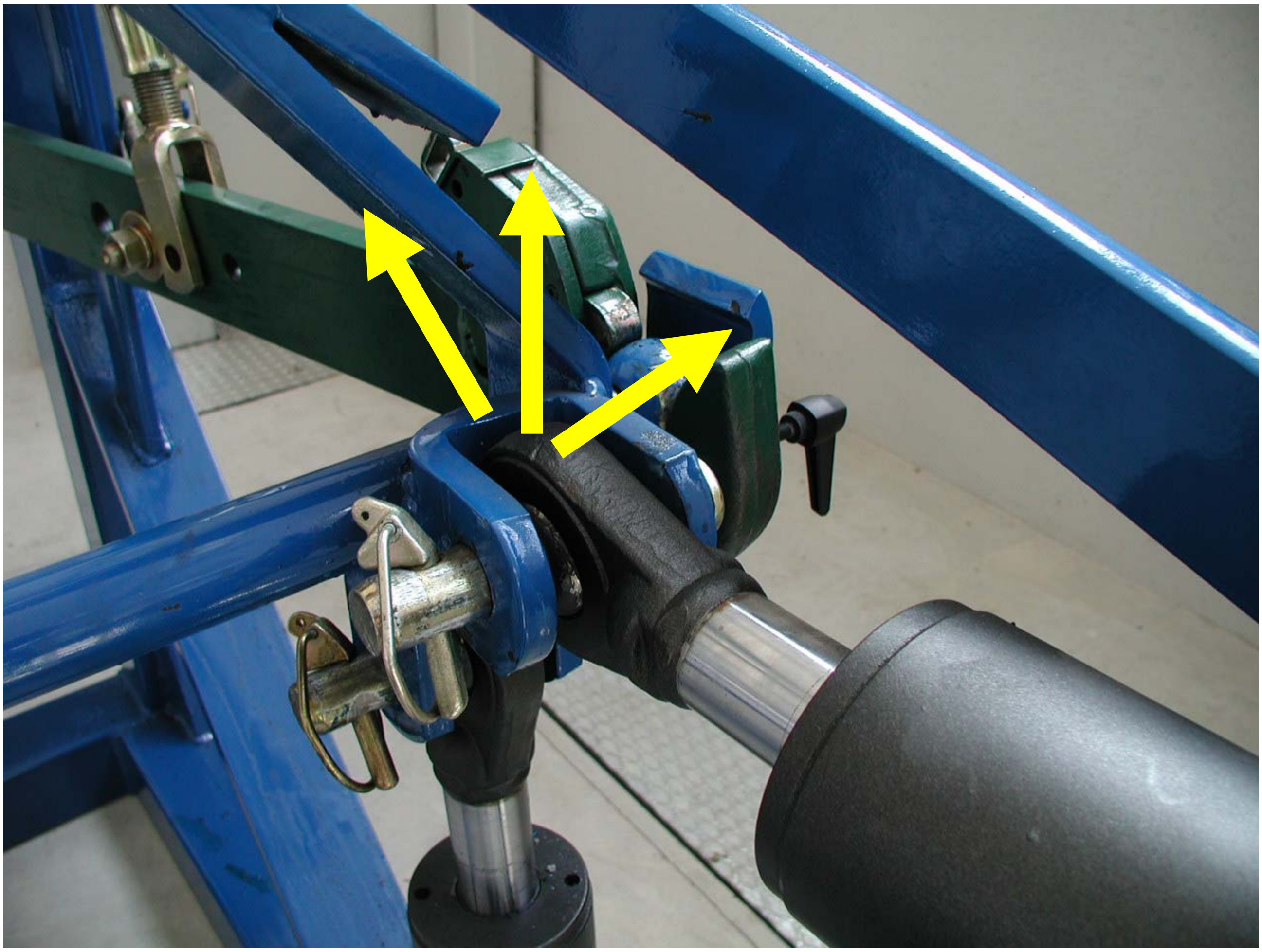

Fig. – 5. Close-up of the two cylinders working in a perpendicular manner and simultaneously on each joint inserted in the lower hooks under adjustable stress (thrust and traction) in order to achieve the exertion results indicated in the figure.

The perpendicular arrangement of the two cylinders created variously oriented stress along the vertical plane passing through the ball joint.

Testing

Hook coupling and release tests were performed manually, using the triangular frame already described, with

operations repeated in sequence, releasing the shutter using ad hoc metal cables.
Static strength tests consisted of the application of forces along various directions of the vertical plane with a view to simulating situations that may give rise to the release of the hook. The maximum load applied was 5,000 kg, deemed to be particularly onerous and indicative for the category of hook being tested. If it does not cause breakage, this limit is deemed indicative of the hook's resistance, and has been set to rule out possible damage that might happen in dynamic situations following the strong buffeting of trailed equipment, typical of some operating conditions.
Tests entailed the application, in sequence and simultaneously for the two hooks, of static loads of 5,000 kg along directions on the vertical plane and having the following angles: 90° upwards, 45° upwards/forward direction, 45° upwards/reverse direction. Tests were repeated applying the same forces both simultaneously and in opposite directions for the two hooks, so as to simulate situations in which trailed implements are jolted laterally. The performance of the hook is viewed positively only if, after all the described applications, there is no complete breakage and/or damage that might have a bearing on the proper functioning or the reliability of the hooking system.

Results

Tests, all performed on the test bench, highlighted the good functioning of the hooks. The manual sequence of coupling/release actions did not cause any problems.
The static strength tests were completed without breakages of any sort. Contact surfaces between the hook and the ball joints, metal shutter and self-locking wing nut did not reveal any noticeable damage. The stop pins underwent a plastic deformation, which did not however have a bearing on the correct functioning of the hook. These stop pins are of limited resistance compared with other parts of the hook, also serving as a mechanical load limiter and expected to yield in the event of extraordinary overloads, thus avoiding damage to other parts that are more costly to replace. The state of stop pins should accordingly be regularly checked.

CONCLUSIONS

Hooking, lifting and release tests highlighted the correct functioning of the devices used to carry out such operations.
The tests performed on the lower hooks, model OGRI 2003, for the quick coupling and release of trailed and/or semi-trailed implements manufactured by the company AMA (ISI Division) applied to the structure of a test bench simulating the cat. ISO II three-point hitch of a tractor, confirmed the correct functioning of the devices during the execution of manual coupling and release cycles, with the successful completion of static strength tests.

THE PRESENT CERTIFICATE IS VALID FOR A PERIOD OF FIVE YEARS OR UNTIL REFERENCE REGULATIONS FOR THE AMA LOWER HOOK, MODEL OGRI 2003, ARE ALTERED, AND IS OFFICIALLY RECOGNISED BY ENAMA MEMBERS:

ASSOCAP (Associazione Nazionale dei Consorzi Agrari) (National Association of Agricultural Consortia)
CIA (Confederazione Italiana Agricoltori)
(Italian Farmers Confederation)
COLDIRETTI (Confederazione Nazionale Coltivatori Diretti)
(National Confederation of Independent Farmers)
CONFAGRICOLTURA (Confederazione Generale Agricoltura)
(General Agricultural Confederation)
UNACMA (Unione Nazionale Commercianti Macchine Agricole)
(National Union of Agricultural Machine Dealers)
UNACOMA (Unione Nazionale Costruttori Macchine Agricole)
(National Union of Agricultural Machine Manufacturers)
UNIMA (Unione Nazionale Imprese Meccanizzazione Agricola)
(National Union of Agricultural Mechanisation Enterprises)

AND BY MEMBERS OF THE EXECUTIVE COUNCIL OF THE ENAMA, IN WHICH THE FOLLOWING ARE ALSO REPRESENTED:

MIPAF (Ministry for Agricultural and Forestry Policies)
Regions and Autonomous Provinces
ISMA (Istituto Sperimentale per la Meccanizzazione Agricola)
(Experimental Institute for Agricultural Mechanisation)

COMPANY WITH QUALITY MANAGEMENT SYSTEM CERTIFIED BY DNV =ISO 9001:2000=

ENAMA - ENTE NAZIONALE PER LA MECCANIZZAZIONE AGRICOLA
(NATIONAL AGRICULTURAL MECHANISATION BODY)
VIA LAZZARO SPALLANZANI, 22/A - 00161 ROME
TEL. 06/4403137-4403872 FAX 06/4403712
email: info@enama.it http://www.enama.it