

THE HYDRAULIC OF THE 350 kN PRESS FOR ALUMINUM CANS BALING

IOSIF DUMITRESCU¹, SORIN MIHĂILESCU²

Abstract: The press packs aluminum cans, compote and 0,8 kg tomato juice cans into bales of 600×400 mm cuts, 350...400 mm long and 40...60 kg weight.

The paper presents legal aspects regarding the construction of the hydraulic system of the press and the cylinder used for the vertical displacement of the weir, for the opening and closing of the pressing chamber, the proper pressing being done with the help of the second cylinder of the press ensemble, which moves horizontally, setting in motion the pressing ram

Key words: press, hydraulic, pump, cylinder, pressing chamber, pressing ram

1. INTRODUCTION

By recycling one kilogram of aluminum, it saves up to 8 kg of bauxite, 4 kg chemical products and 14 kWh energy. One box of recycled aluminum saves equivalent energy to operate a TV for 3 hours.

In solid municipal waste, aluminum is the main non-ferrous metal, it represents about 80...85% of total contain of non-ferrous metal. By aluminum recovery, it can be obtained an income of 20 times higher per tone than by glass recovery, steel dose or paper. Recycling waste like paper, cardboard, aluminum dose are baled for easier manipulation and to reduce transporting costs. Baling equipment materials compress on one or many directions by applying pressure of (14...25) MPa with a hydraulic cylinder.

Metallic press construction of 300 kN for baling aluminum doses, is object of this paper. This press has to do bales of doses with section of 600×400 mm, length between 350 and 400 mm and mass between 40 and 60 kg. Press funnel allows retrieving a container of 1,1 m³.

Using MathCAD software, it was drawn up a program for sizing and checking metallic construction, done by analysis with finite elements.

¹ *Assoc. prof., Eng. Ph.D., University of Petroșani, iosif_dumi@yahoo.com*

² *Assoc. prof., Eng. Ph.D., University of Petroșani, mihailescus@gmail.com*

2. PRESS CONSTRUCTION AND FUNCTIONING FOR BALING ALUMINUM DOSES

Press compacts aluminum doses, cans of stewed, tomato juice of 0.8 kg in bales with section of 600×400 mm, length between 350 and 400 mm and mass between 40 and 60 kg. Press funnel allows retrieving a container of 1.1 m³. Bale is ejected to the end of pressing cycle with pressing hydraulic cylinder, 140×110×1150 mm, which exerts a pressing force of over 300 kN. Technological parameters, force and the control panel, provided also with a microprocessor, controls speed, of the bale pressing and evacuation operations.

In figure 1 it is presented the 3D model of the press for baling aluminum doses, which is composed of: 1 – trough; 2 – ram; 3 – dam; 4 – funnel; 5 – hydraulic installation; 6 – pressing cylinder; 7 – cylinder dam; 8 – bale discharge trough. In figure 1.a it is presented the ram retired head of the race, while and in figure 1.b it is presented the ram at maximum pressing race of 950 mm.

When the ram race is between 520 and 570 mm, and the pressure from pressing cylinder reached the maximum adjusted value between 20 and 25 MPa, the operation for forming the bale with dimensions 600×400×(350...400) mm is considered ended, the command is to raise the ram and to evacuate the bale, the pressing cylinder making the maximum race of 1150 mm.

3. HYDRAULIC INSTALLATION OF 350 KN FOR BALING ALUMINUM DOSES

In figure 2, it is presented the hydraulic installation scheme press of 350 kN for aluminum doses, composed of: 1 – electric-hydraulic group; 2 – block command; 3 – pressing cylinder; 4 – cylinder dam.

The electric-hydraulic group is presented in figure 3 and is composed by an electric motor 1, of 15 kW, which actions a pump with axial pistons and adjustable flow 2, type PVPC-LQZ-3029/D, by a flexible coupling 3, type ND108B. The electric motor has four screws M16×65 on cover 4 of the container, and the pump is set on housing 5, type TH4-101E, with two screws M14×40. Pump has a suction filter 6, type 100-1G1, fixed on the pump body with two ties 1 1/4FH 3004, the discharge is done through a hose Dn 19 KP420, rep. 7, which is caught by pump with two ties 3/4FH6002 and on the container board with a crossing jack Dn19-M36×2 – XSV NW20HS. On the container board there are also mounted the return filter 8, type MPH100A10 4 105, the cover with filter for oil filling 9, type TA80B03A1L1P01, and the electronic indicator level 10, type LENA2001A1AFSP01.

In figure 4 it is presented the hydraulic group of press, which is composed of: 1 – metallic framework of the container; 2 – electric-hydraulic group; 3 – support command block; 4 – command block; 5 – hose Dn19 for tour; 6 – hose Dn32 for return; 7 – container drain plug; 8 – roof; 9 – inspection cover.

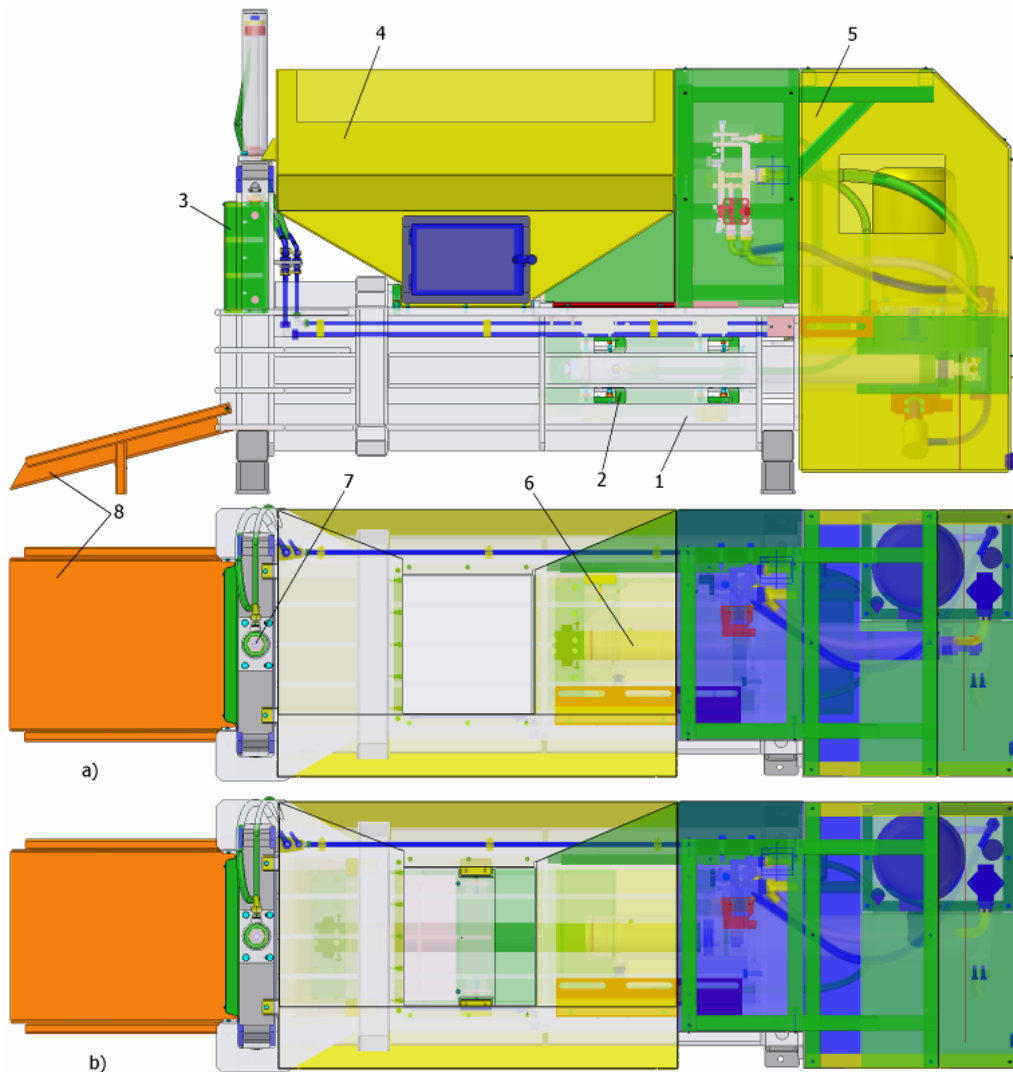


Fig. 1. 3D model of press for baling aluminum doses [1, 2]

In figure 5 it is presented the press command block, composed by: 1 – body hydraulic block; 2 – safety valve AGAM 20/350; 3 – piloted hydraulic distributor DPHI 2713- \times -24DC; 4 – modular safety valve KM-105; 5 – hydraulic distributor DKE 1714- \times -24DC; 6 – hydraulic distributor DKE 1611- \times -24DC; 7 – tour hose connection G1-M36 \times 2; 8 – return hose connection G11/4-M45 \times 2; 9 – hose connection for full pressing cylinder section G11/4-M45 \times 2; 10 – hose connection for annular section of pressing cylinder G1-M36 \times 2; 11 – hose connection for full dam hydraulic section G3/4-M30 \times 2; 12 – hose connection for annular section of dam cylinder G3/8-M22 \times 1,5; 13 – cover for manometer outlet.

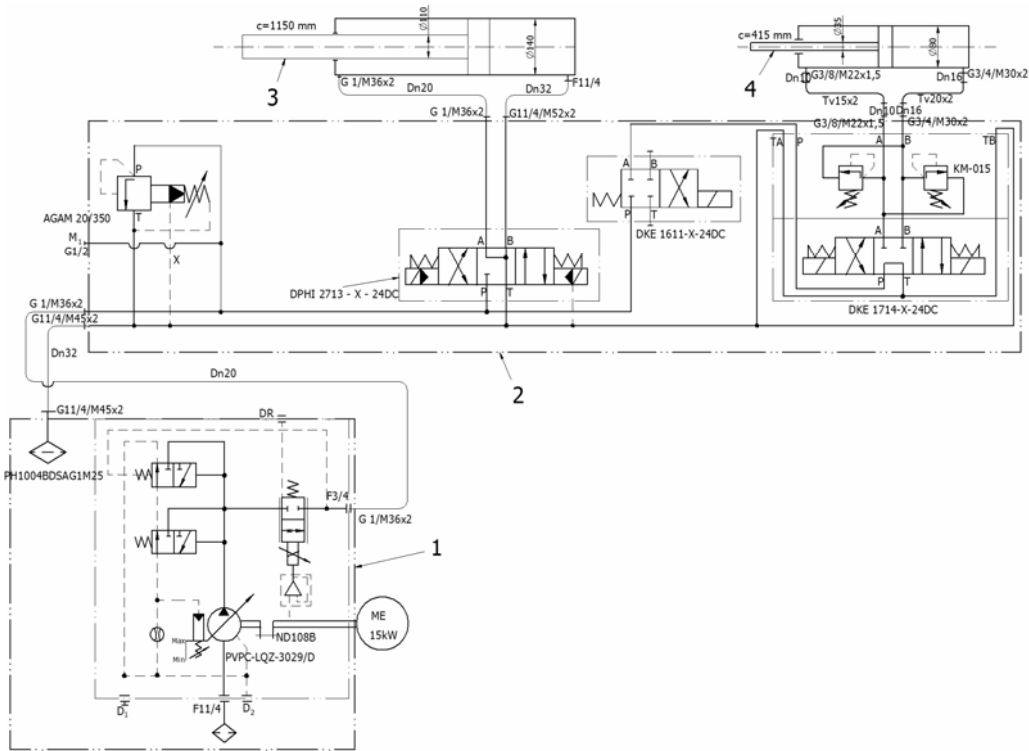


Fig. 2. Press hydraulic scheme of 350 kN [1, 4]

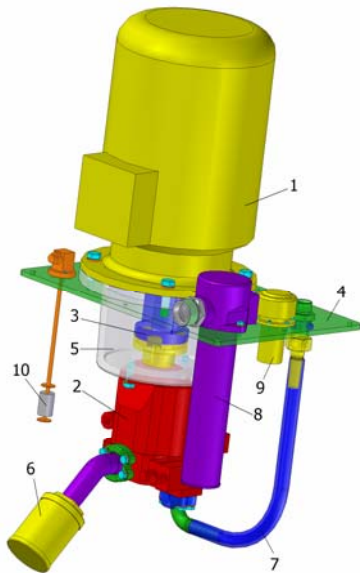


Fig. 3. Electric-hydraulic group [1, 2]

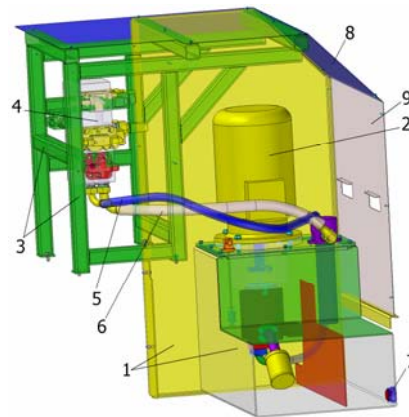


Fig. 4. Press hydraulic group [1, 2]

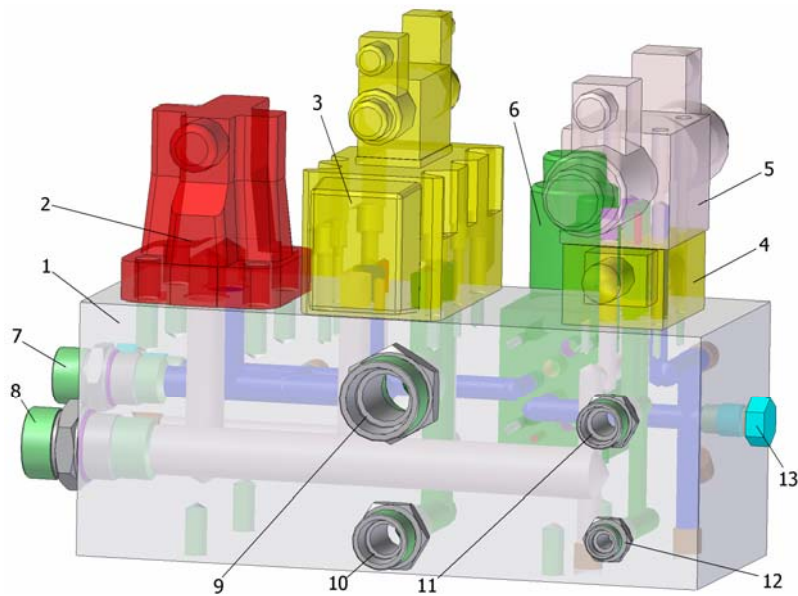


Fig. 5. Hydraulic command block [1, 4]

In figure 6 it is presented command block body, where, with blue are the holes for pressure, yellow are the holes for return, with purple are the holes of cylinder supply, with green the threaded holes for connection and screws and white, the holes where are mounted by welding, the closing covers of the connection holes.

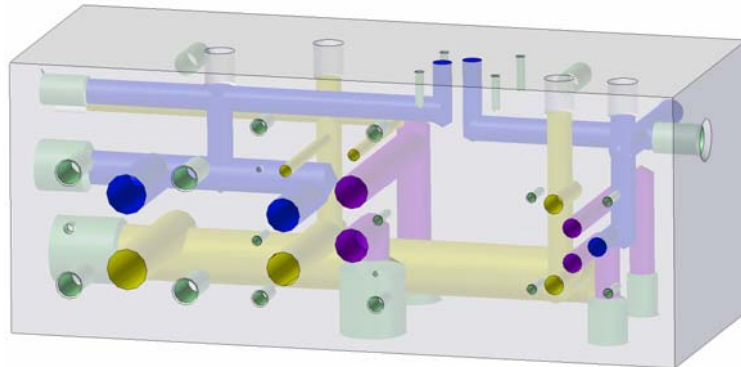


Fig. 6. Command block body [1, 3]

4. HYDRAULIC CYLINDER CONSTRUCTION

In figure 7 it is presented the constructive solution of pressing cylinder $\text{Ø}140 \times \text{Ø}110 \times 1150$ mm, which is composed by: 1 – cylinder pipe; 2 – rod; 3 – nut M48×3; 4 – piston; 5 – guide ring EV8513514015; 6 – cuff for piston TPM551472; 7 – ring O 35506300; 8 – spacer ring; 9 – gland; 10 – ring O 35513200; 11 – guide ring

EV8511011515; 12 – cuff for gland TTI1101251; 13 – scraper ring GHK110122712.

For damping head of the race, at closing cylinder, in cover there is a hole for the threaded end of the rod with a tunnel of $\text{Ø}3$ mm for ejecting the oil. In addition, for improving guiding rod and piston, there are used three guide rings, one on the back of the piston and two on the gland to the cylinder interior for lubrication.

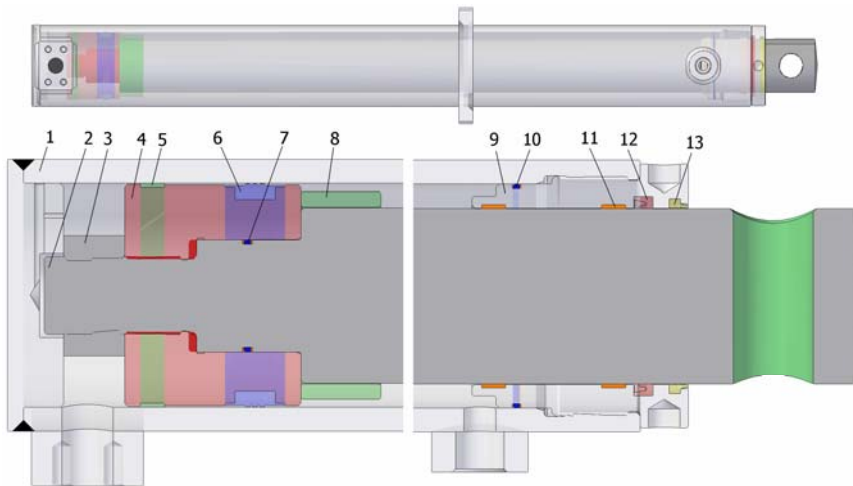


Fig. 7. Pressing hydraulic cylinder [1, 4]

In figure 8 it is presented the constructive solution of the dam cylinder, composed by: 1 – cylinder pipe; 2 – rod; 3 – nut M20; 4 – piston; 5 – connection G3/4-M30×2; 6 – guide ring EV85758015; 7 – cuff for piston TPM314236ISO; 8 – ring O 26502000; 9 – guide ring EV85354056; 10 – gland; 11 - connection G3/8-M22×1,5; 12 – ring O 35507300; 13 – cuff for gland TTI35451ISO; 14 – scraper ring GHK354357.

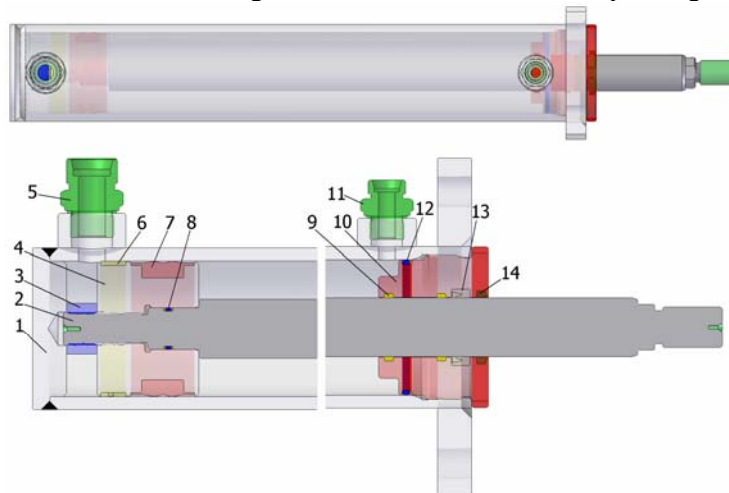


Fig. 8. Hydraulic cylinder for dam [1, 4]

With COSMOS Design STAR 4.0 program was performed a linear static analysis of dam cylinder to a pressure of 16 MPa, and how to apply pipe, piston and rot are presented in figure 9. It can be noticed that tensions on the pipe don't exceed the value 76,34 MPa, close to 85,33 MPa determined by an analytical calculation. The maximum value results on the outdoor arm of the piston, where the guide ring is mounted.

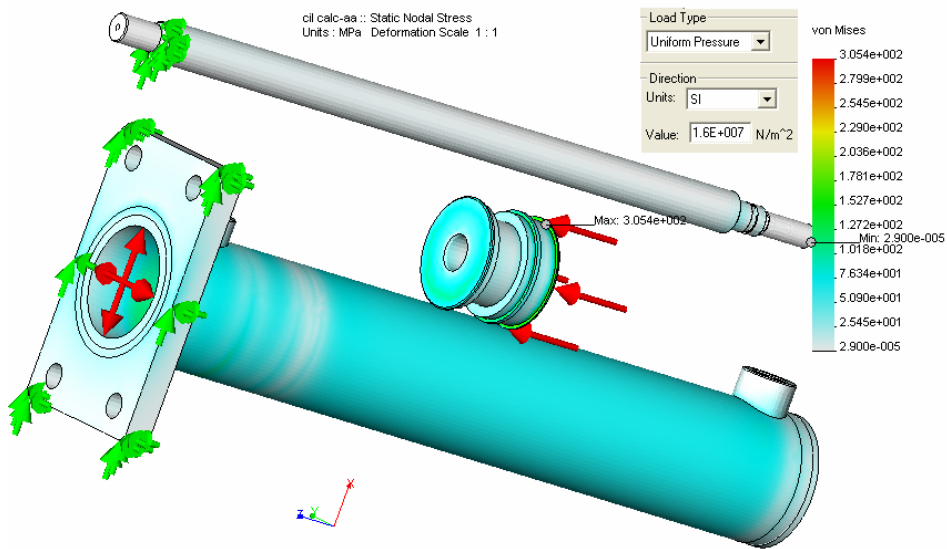


Fig. 9. Analysis with finite elements of the dam cylinder

4. CONCLUSIONS

On the base of the elaborate technical documentation it has been made, the baler of aluminum doses at Adarco Invest SRL Aninoasa, and in figures 10, 11, 12 and 13 is presented the baler while trying to be in function and approval of the mechanical characteristics.



Fig. 10. Hydraulic cylinder for dam



Fig. 11. Electric-hydraulic group with command block and pressing cylinder



Fig. 12. Bale of aluminum doses



Fig. 13. Way of exhaust of bale from aluminum doses

An important problem to be solved at baler for aluminum doses is achieving and maintaining cohesion of the baler while exhaust and maneuvering. In case of the baler presented, this problem was solved by hydraulic installation, by keeping a constant volume of the baler and raising pressure, of force for pressing, on every race, 10 – 12 races/baler, until reaching the maximum pressure of 25 MPa.

A novelty of hydraulic installation is the pump with axial pistons of adjustable flow, type PVPC-LQZ-3029/D, which allows the adjustment of the electronic flow, with a driver from the control panel processor, depending on the function cycle, pressing cylinder supply, dam cylinder or idle operation.

REFERENCES

- [1]. ***, *Technical documentation of execution for baler of aluminum doses*, SC Adarco Invest SRL Aninoasa;
- [2]. Muscă, G., *Aided design using Solid Edge*, Publisher Junimea, Iași, 2006
- [3]. Dumitrescu, I., Jula, D., *Manufacturing engineering*, Publisher Universitas, Petroșani, 2010
- [4]. ***, *Product catalogue of companies ATOS, EVCO, HANSA FLEX and MPFILTRI*.