



## THE MANAGEMENT OF WORK RISK FOR A PLATE ROLLING MILL MACHINE

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### ABSTRACT

*Arcelor Mittal is the leader on important iron and steel global markets. This company has a performant system for research, for iron and steel plate production and has a top network for distribution, too.*

*The company has production units in 20 countries on 4 continents, in all key markets of iron and steel industry. Arcelor Mittal has committed to operating in its units in a responsible manner and has taken care of the health, safety and welfare of its employees. At the same time, it is committed to acting with respect to sustainable development.*

KEYWORDS: work risk, safety at work places, risk management

### 1. Introduction

Arcelor Mittal Galati is one of the most powerful companies in the south-east of Europe. Analysis of such work will be carried out in laths thick plate nr 2. Thick plate steel rolling mill machine no. 2 (L.T.G. 2) is included in the factory of flat laminates, which are located in the northern part of the mill. The main objective of activity is to obtain finished products like thick plates. Rolling mill machine no. 2 has the purpose to products thick plate with the thickness of 6-120 mm and the width between 1600-4200 mm.

Like every grate unit, the workers take contact daily with risk factors that can affect their integrity and health.

***Risk factors that can exist in the rolling mill process:***

The most important risk factors that appear in rolling mill process are:

1. mechanical chain, coupling, unprotected rolls with specialized cage;
2. bruising caused by diverse transport systems inside the factory;
3. self starting of scissors, crane and rolls of plates transport;
4. sliding or rolling of parts that are stored in not allowed places;
5. tipping over parts, assemblies, materials, stored without ensuring their stability;
6. free drop of parts, equipment, tools that can injure the workers;

7. disposal of iron or steel particles, parts of transmission elements from the rollers without fenders;

8. deviation from normal trajectory of the plates during processing;

9. splash of oil at an accidental crack of hydraulic circuits;

10. separate stings and cuts caused by dangerous surfaces or contours;

11. working in the neighborhood of pressure vessels;

12. low temperature of metallic surface (in cold weather) that workers get contact with;

13. flames that appear because of electrical panel.

### 2. Research targeting factors that may jeopardize job security

After the investigations at the thick steel plate rolling mill machine, Heavy Plate Rolling Mill no. 2 (LTG-2) made by the authors between 15.06 2012 - 15.12.2012, the following causes that can injure workers on mill were revealed:

- electrocution by direct touch, because there have been found uninsured and noninsulated ways of electric power, noninsulated switchboards, improvised electrical connections etc.

- electrocution by indirect touch because there have been found earthing connection systems of the damaged equipment;

- electrocution at voltage appearance because there are electrically operated equipment working in wet environment without protection;
- working with toxic substances - mineral oils, paraffin waxes etc.;
- working with caustic substances - water + phosphates mixture in coolers;
- working with flammable substances - oils, greases etc.;
- high air temperature ( $> 40^{\circ} \text{C}$ ) in the vicinity of the furnace, on the crossing bridges of the rolling path etc;
- low air temperature during winter - when running repairs (when stationary);
- airflow - leak site, open doors, etc.;
- low lighting level – suspended particles in the air, missing lighting lamps etc.;
- high contrast between the light emitted by incandescent material and general background

- lighting of the enclosure, which can lead to overuse of vision;
- infrared radiation from incandescent material;
- high work rate - due to the functioning mill;
- the execution of contingency operations in work load or differently than it is stipulated in the technical work;
- setting work parameters beyond the prescribed areas of technology work;
- trouble with other performers - working mill is an action team;
- turning on machinery without permission from the checkpoint;
- disruption of the cooling circuit;
- fall on the same level by imbalance, slipping, tripping – walking on slippery surfaces loaded with dust, leaking, etc.
- falls from height: by stepping into the void, by imbalance, by sliding - septic technology without railings, without warning indication.



*Fig. 1. View of L.T.G.-2[1]*

### 3. Measurement and prioritizing risk factors at LTG-2

Research targeting main factors in terms of job security in Heavy Plate Mill No. 2 allowed measurement both in terms of unsafety level and priority.

We named factors starting with F1 to F15 and built the diagram in Figure 2 based on these risk factors, namely:

F1 - lack of protection for some gear wheels, couplings and cinematic chains (gear box, coupling and unprotected cinematic chain;

F2 - click Start-spot inspection of fly scissors, crane or rollers of plates transport;

F3 - design particle - skims, transmission elements from rolls (without device), quick couplers balance and so on;

F4 - normal trajectory deviation of the blank (band) during rolling;

F5 - electrical shock because of unprotected electrical current cable, uninsured electrical panels, improvised electrical connections etc.;

F6 - high air temperature ( $> 40^{\circ} \text{C}$ ) in the vicinity of the furnace, on the bridges crossing the rolling path etc.;

F7 - high noise level;

F8 -infrared radiation from incandescent material;

F9 - pneumoniconiosis powders present in workplace air;

F10 - making difficult decisions in a very short period of time, when dealing with situations of "incident" or "fault" type;

F11 - fall on the same level by imbalance, slipping, tripping - slippery caused by walking on surfaces loaded with dust, leaks etc.;

F12 - contact with dangerous surfaces or contours (pungent, sharp, slippery, abrasive, adhesive);

F13 - free fall of parts, materials, tools at higher rates;

F14 - walking, stops in dangerous areas on access roads, car or rail, stand rolling mill, roller path on walkways etc.;

F15 - failure of using labor protection equipment and installations and other means of protection granted by the employer.

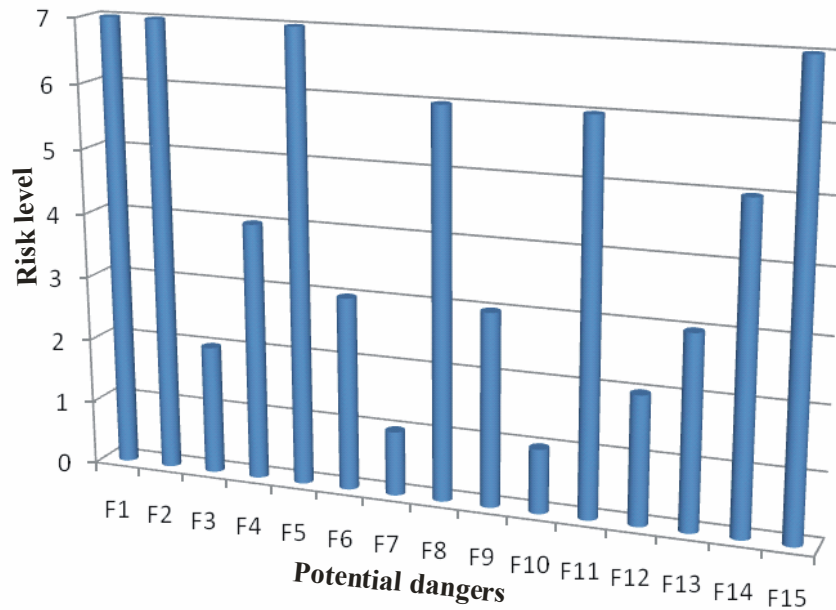


Fig. 2. Variation of potential dangers in connection with risk level [3].

It is noticed that the maximum potential danger is at positions F1 (gear box, coupling and unprotected cinematic chain), F2 (click Start-spot inspection of fly scissors, crane or rollers of plates transport), F5 (Electrical Shock, because of unprotected electrical current cable, unensured electrical panels, improvised electrical connections and F15. The minimum for potential danger is at position F7 (high noise level) and F10 (Making difficult decisions in a very short period of time, when dealing with situations of "incident" or "fault" type).

### 3.1. Calculus and measurement of risk level

$$N_r = \frac{\sum_{i=1}^n r_i \cdot R_i}{\sum_{i=1}^n r_i} \quad (1)$$

which:

$N_r$  - level of global risk at work place;

$r_i$  - risk factor "i";

$R_i$  - the risk level for a risk factor "i";

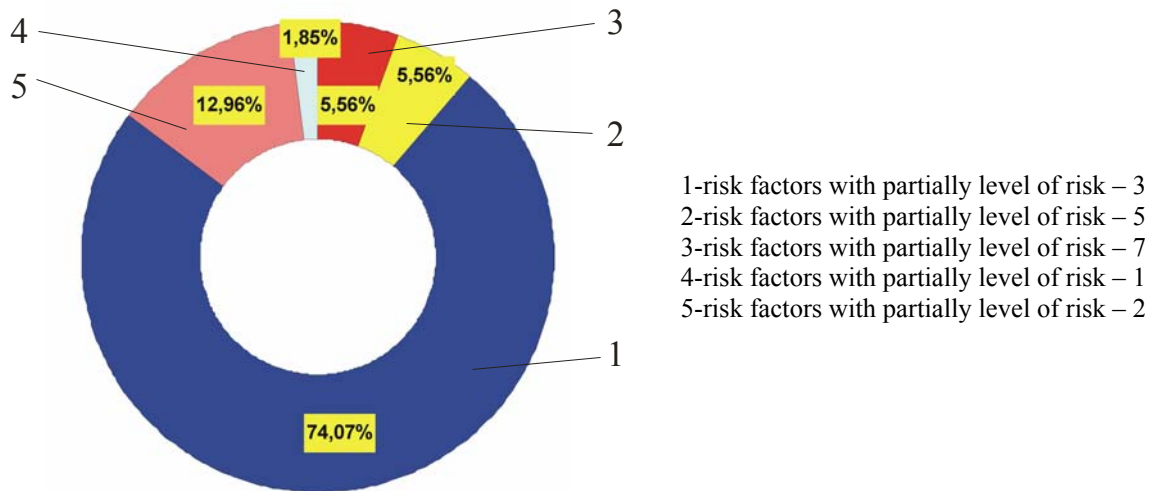
$n$  - number of risk factors that were identified at each work level.

$$N_r = (7+7+2+4+7+3+1+6+3+1+6+2+3+5+7)/15 = 64/15 = 4.26$$

This value of 4.26 resulted from the calculation made by formula (1) shows that "laminator" work falls into the category of jobs with partial risk level.

In Figure 3 we show the share of risk factors identified by the partial values of the levels of risk.

It is noticed that the risk factors with the greatest share while working is over 74%. Another risk class (secondary) has the value over 12% and the third is about 5.5%.



**Fig. 3.** The share of risk factors identified by the partial values levels of the risk.[3]

#### 4. Conclusions

According to the research performed on job security in the thick steel plate Rolling Mill machine no. 2 (LTG 2) we conclude that the main measures to be taken to secure these jobs are:

- using personal protective equipment and means of collective labor protection equipment;
- attending daily and quarterly briefings on security or safety line in section mills;
- conducting periodic medical examination in due time;
- not initiating work if restricted marks and registers do not exist at the control station and immediately announcing the supervisor;
- using of stopping restriction trademarks, repairing and restarting the mill machinery;
- maintaining protective railings, guards and protective cases from moving car bodies and protective railings on stairwells and walkways;
- using special cables and chains, metrologically checked and endowed with panels with the maximum charge allowed for the evacuation of bucket drops;
- failure of interventions to under pressure plants, lifting and transport if there are no appropriate qualifications;
- failure of loads bidding activities at and from lifting hook, unless the worker is trained and authorized as slinger or the worker;
- non-use of unapproved binding elements and devices, improvised and/or unregistered in registers at work;
- non-use of tools, devices and controllers not approved, worn out and/or improvised;
- the issue of access ladders, working platforms and traffic routes with materials, parts, waste, and so on;

- carrying out operational activities of technical machinery in mills based on working instructions and safety;
- non-interference in the mill machinery if it is not stopped and secured against accidental starting;
- performing installation work – remove of stand rolling mill, of support and working cylinders only when the rolling mill does not function.
- taking measures to exclude fall of slag drop or other objects while performing cleaning activities of scale channels;
- unsteady at a distance of less than 5 meters from the machines of the mill, under running (way roller degrosor train, train wheel, rulors, transercars, chain conveyor, tandem, furnaces, etc.) excepting operators in the area;
- non-intervention with bare hands on semifinished or reddening table elements (hot elements);
- non-intervention in rolls strapping machine while tied wrap roll band;
- immediate shutdown of equipment where there is imminent risk of injury;
- use of access routes and movement marked, well lit and suitably delimited slippery, while walking from one work station to another;
- do not going over moving conveyor chains;
- non-interference in electrical systems for remedying faults;
- waste and drop deposit (waste of scissors cutting laminates) in spaces designated for that purpose;
- conducting activities so as to prevent injury or occupational illness to yourself or other employees of the business;
- performing only activities that are authorized according to legal requirements.



If these measures are respected by the workers of Heavy Plate Mill No. 2, the risk of the job will greatly decrease and thus the personal safety for these jobs will increase.

### References

[1]. \*\*\* - Instrucțiunea de lucru la laminatul de Tabla Groasa nr.2 "I.L – 007/2012, rev. 0";

[2]. \*\*\* - Instrucțiunea de lucru la paturile de racire "I.L. –L - 107/2007, rev.0";

[3]. \*\*\* - Instrucțiunea tehnică de lucru privind exploatarea și întreținerea sistemelor de protecție și siguranță la laminor „I.L.-L – 015/2007, rev. 1”;

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[5]. \*\*\* - Cartea lucratorului laminatorist- Ed. Interna. Rev. 2012.