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Rationing and Motivation System for Workers of Production Crew on the Example of the Tubular Mill Workers

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Abstract. Despite high rates of market model economy development in Russia, elements of planned system keep the relevance to this day. So, the production organization of the successful enterprises of the Ural region and the country in general, often includes the adapted techniques of 20, 30 and 50 years old. One of the directions of the corresponding this tendency is work rationing. Increase of productivity became one of the most important criteria of the overall industrial enterprise performance. We consider that a fundamental factor of success at the moment is the human factor, that includes the topics of rationing (norm fixing), workers motivation (different categories are considered: main, auxiliary workers) and motivational stimulation systems. Researches were carried out on one of sites of production of straight-line-seam electrowelded pipes. The reasons of low efficiency and labor productivity at the explored enterprise are systematized. Essence of this article – the detailed description of a method of increase of productivity of a pipe camp through change of system of motivation of the personnel and introduction of a new technique of rationing of work.

1. Introduction

Increase of productivity became one of the most important criteria of the overall industrial enterprise performance. On the other hand, experience of the last years shows that the simple equipment replacement on more modern, powerful, productive doesn't lead to the desirable level of efficiency (productivity) increase. We consider that a fundamental factor of success at the moment is the human factor – for stable and high-quality excess of productivity it is necessary to create effective motivational system.

Researches were carried out on one of sites of production of straight-line-seam electrowelded pipes of JSC Yalutorovsk Automobile Plant. On this site the tubular mill for production of round and shaped steel pipes is located. On the site are also located: storage of raw materials – strips, storage of equipment and necessary spare parts, a site of packing and lying of ready packs, finished products storage. The camp is operated by crew from seven people.

Need of productivity increase of the site in the conditions of current state of a sales market of shaped pipes dictated need of introduction of effective motivation and salary systems that demanded carrying out the careful analysis of a condition of working crews, their relation to own activity and search of the motivating factors.

During research the hypothesis of possibility of successful application in different production types of straight-line-seam electrowelded pipes of motivation system with a "unattainable" maximum

possible salary is made and proved. Author's calculations of compensation level taking into account the offered parameters are given in article. Statistical data of the industrial enterprise before introduction of system are provided in research and the resulting indicators after introduction of the offered technique are shown.

2. Modern situation

At the time of the beginning of supervision (summer of 2014) production teams possessed the acceptable universality. Productivity of the equipment from the point of view of its technical and technological opportunities allowed to increase pipe production essentially.

During the analysis which included some stages, one of the major limiting factors – unwillingness of workers to increase productivity because of uncertain dependence of their wage on volume of the production – was revealed. In other words, workers didn't see need to do more production for the same average wage which was paid them.

After definition of this factor the analysis of statistics for 2014 in the following parameters was made:

- the number of the workers on the site,
- quantity of the made pipes on the site per each working crew,
- the salary of each speciality of working crews of the site,
- quantity and times of readjustments of the tubular mill,
- quantity and times of repairs of the tubular mill,
- reasons and times of downtimes of the tubular mill. [1]

Data for the second half of the year 2014 on the studied site are provided in table 1.

Table 1. The paid wage in terms of ton of finished goods or one unit of finished goods.

Month	Average wage per one pipe [roubles]
July	28.01
August	75.05
September	19.98
October	17.80
November	39.90
December	27.20
AVERAGE	26.71

From the table it is visible that the wage part in the cost of finished goods is unstable and, in fact, chaotically changes. At the same time the quantity of finished goods on months didn't differ more than for 15% from average monthly quantity for this period. The carried out correlation analysis only confirmed absence of interrelation between the monthly quantity and the paid wage that is considered inadmissible.

It should be noted that the wage system at the enterprise is time wage, however the wage consists of two parts – fixed salary and bonus. And bonus depends on production plan, quantity of produced pipes and some subjective factors. The applied wage system difficult for understanding workers, that confirms need of its modernization.

During negotiations with owners of the enterprise and workers of the site criteria of the acceptability of new wage system were installed: for the management the main criterion is the size of the added wage in the cost of one pipe, for workers – the size of an average monthly wage which they will receive.

For a basis of new wage system the model at which 100% of labor time was spent on production, without downtimes, was chosen. And for establishment of reference productivity the maximum registered actual speed of tubular mill on the studied site was taken.

Using the first criterion of the acceptability – wage size per one pipe – the maximum possible wage volume for a working crew proceeding from the maximum possible productivity of the site calculated

on the maximum registered actual speed of tubular mill was established. In other words, the maximum possible wage for each worker (speciality) of the site through the maximum possible wage of working crew was established.

The common decision of the management established maximum wage size for all specialist with different qualification in working crew. The maximum wage for the senior operator defined a wage of other workers: the maximum wage of operators and the welder was established at the level of 0,9, and a wage of ancillary workers at the level of 0,6 from the wage of the senior operator.

The established maximum possible wage for all workers consists of two parts: fixed salary, the minimum amount of wage, and bonus. [2]

The established size of the maximum possible wage at the same time is unattainable because it is possible only with maximum productivity. In other words, workers can receive maximum established wage only in case when they spend 100% of working time for producing pipes with maximum productivity without downtimes and at the maximum possible recorded speed of tubular mill.

3. The new model of norm-fixing and motivation

After the analysis of statistics of time spent for carrying out emergency and planned repairs, and also time spent for readjustments and non-productive downtimes on the studied site for the second half of the year 2014 the following conclusions were made:

- The average time of readjustment – 8 hours.
- Average quantity of readjustments in a month – 4.
- Average quantity of hours in a month spent for accidents elimination – 16.
- The most frequent cause of accident – bearing degradation in rolling mills of the line.
- Preventive repairs usually were provided during readjustments and separately weren't allocated.
- 85% of non-productive works – readjustments and repairs – are carried out by working crew, the rest – with involvement of other specialists of the enterprise – electricians, electronics engineers and mechanics.
- Time of the breaks connected with violation of labor discipline is insignificant and was reflected in timeboard in the form of hours of absence in a workplace.

Proceeding from the accepted structure of working time, and also from the analysis of the data obtained during research of the actual expenses of working hours on the site the following scheme of wage calculation is assumed as a basis:

$$W = A \times X + B \times Y + C, \quad (1)$$

where

W – a wage of one worker in a month,

A – the cost of production hour calculated from the maximum possible wage of the worker;

X – quantity of production hours;

B – cost of non-productive hour;

Y – quantity of non-productive hours;

C – stimulating additive or penalty deduction of wage, accepted on monthly results to the discretion of the site manager; it is entered as the additional variable, by default is accepted equal to zero.

Quantity of production hours X – the main variable which determines the size of future wage of the worker. It can be expressed by a formula:

$$X = Xpipe + Xadj, \quad (2)$$

where

Xpipe – a quantity of hours, determined by the quantity of produced pipes;

Xadj – a number of hours, taken away on readjustment of the line; following the results of the analysis of statistical data for the II half-year 2014 is established to equal 8 hours per one readjustment.

The hours determined by the quantity of produced pipes Xpipe according to earlier accepted arrangements can be calculated on a formula:

$$Xpipe = N / No, \quad (3)$$

where

N – quantity of produced pipes for last month;

No – the normalized quantity of pipes which can be produced in one hour at the maximum possible actual speed without stops for a specific size of pipes.

The quantity of non-productive hours Y is defined as a difference between the hours specified in the sheet of crew Ttab and quantity of production hours:

$$Y = Ttab - X \quad (4)$$

The cost of production hour A is calculated from the maximum possible wage of the worker:

$$A = Wmax / Tm, \quad (5)$$

where

Wmax – the maximum monthly wage for the specific worker of working crew;

Tm – quantity of hours in last month according to an operating schedule.

The cost of non-productive hour B can be calculated from fixed salary of the worker:

$$B = S / Tm, \quad (6)$$

where

S – a monthly fixed minimum salary of the specific worker of working crew according to the staff list.

Considering wide nomenclature of pipes made on the tubular mill, and also the average number of readjustments in a month, the normalized quantity of pipes in an hour No is established for each specific size of pipes made on the site. Then the specified formula for calculation of quantity of production hours X in last month can be presented in the following form [3]:

$$X = \sum_{i=1}^{n} \frac{N_i}{No_i} + 8 \times m, \quad (7)$$

where

n – quantity of the produced sizes of pipes for last month;

m – quantity of the readjustments which are carried out for last month.

Generally n and m can differ on 1 (one) in this or that party, or to be equal: month can begin and come to an end with readjustment, begin or come to an end with readjustment, begin and come to an end with production of a pipe.

It should be added that the entered additional variable C can be used and is actually used at the enterprise for adding or depriving of some bonus of certain workers. For example, in case of violation of the order on obligatory existence of a protective helmet on the head, or smoking in not put places negative value of this variable is applied. Or in case of manifestation of special skills or performance of additional works in coordination with the management the stimulating payment with a plus can be applied.

After all assumptions and transformations the total formula for wage calculation of workers will be following:

$$W = \frac{Wmax}{Tm} \times X + \frac{S}{Tm} \times (Ttab - X) + C \quad (8)$$

Thus, all the time spent for service of the line and repairs, including emergency and planned repairs, and also time spent on readjustment of the line over the stipulated eight hours is offered to be paid with a fixed minimum salary according to the staff list that will have to stimulate working crew to reduce this time to a minimum.

At this stage it was necessary to carry out the analysis of statistical data with the purpose of determination of the acceptable values Wmax for each worker of crew.

4. The results of the experiment

After preliminary coordination of the specified wage calculation system between workers and owners of the enterprise, data of the studied period – for the II half-year 2014 – were considered again. Using data of supervision and official reports from workplaces, thereby having on hands empirically established values of No for each standard size of the made pipes, known quantities of the made pipes and quantity of readjustments in last month, and making a start from the established maximum size of a wage in terms of one produced pipe, using the trial and error method values of Wmax were calculated for each worker of working crew.

In table 2 values of actually paid wage in terms of the unit of production and analogous values received with using of new wage calculating system are given below:

Table 2. Comparison of wage calculating systems.

Month	Average ACTUAL wage fund per one pipe [roubles]	Average SUGGESTED wage fund per one pipe [roubles]	Difference between ACTUAL and SUGGESTED in relation to the ACTUAL
July	28.01	23,89	14,72%
August	75.05	26,40	64,83%
September	19.98	17,34	13,20%
October	17.80	16,53	7,14%
November	39.90	21,77	45,45%
December	27.20	22,51	17,26%
AVERAGE	26.71	19,84	25,74%

Making a start from the calculated parameters, the following values of Wmax for workers were established: the senior operator – 45 000 rubles, the operator/welder – 38 000 rubles, the ancillary worker – 30 000 rubles.

It is necessary to specify that the average wage paid on the studied site for the II quarter 2014 to main workers was 20-22 thousands rubles, the ancillary worker – 15-17 thousands rubles. Thus from the data provided above it is visible that if charge was carried out according to the suggested wage calculating system, the salary would be significantly less. These data were provided to all participants of research. At the same time it was explained to workers that maintaining workability of the line and speed of pipe rolling at the set level, providing readjustment not more slowly, than in eight hours, it is possible to achieve double increase in a wage for each worker on a site [4].

Having designated Wmax directly to workers of the tubular mill, the unexpected result was received: crew foremen and skilled workers began to offer ways of increase of speed of work of the production line! For the transition period – January, 2015 – the decision to calculate a wage in two ways – old and suggested was made – and to pay the greatest. Thereby it helped to remove a certain workers' fear of the future changes. Since February, 2015 new system of wage calculation was entered by the order on production [5]. The main conditions and norms of production on all made types and dimensions of pipes were fixed in it.

One of the biggest achievements of new motivational system is qualitatively other approach of workers to their duties. Supervision showed that remembering about low payment of repair work and other non-productive downtimes, working crews began to be late for service of the tubular mill, repairs began to take place quicker, some improvement suggestions from operators were realized, including on work of warehouse.

Supervision in February-March, 2015 showed:

- Average productivity of the line in eight-hour shift increased from 65 tons to 85 tons;
- Speed of rolling increased by 15%;
- The quantity of the same pipes in eight-hour shift increased from the maximum 640 pipes in 2014 to 1040 pipes in March, 2015;
- The average wage fund per one pipe decreased in March, 2015 to 17 rubles.

Results of application of new motivational system are recognized successful, it is offered to management of the enterprise to adapt this system of motivation and wage calculation for other sites of shaped pipes production [6].

After some updates and changes in the conditions of the specific enterprises this system can be applied in machining processing workshops and sites focused on serial or long-run production.

5. Conclusion

According to the results of the study, the following conclusions:

- The currently existing system of motivation of production workers does not correspond to the changing conditions of the environment, development needs of the enterprise and its effectiveness;
- Incentive system support and service workers can not create an effective system to ensure necessary conditions for the manufacturing process of productive work;
- The proposed system will make the motivational system of production workers a simple, transparent and understandable, that meets the requirements of the effectiveness of the incentive scheme of the personnel of industrial enterprises;
- The use of relatively simple and standardized formulas allows you to not complicate the process of payroll;
- The proposed incentive system involves remuneration dependent on several parameters, such as the level of output of non-defective finished products, the level of development, product quality, labor discipline;
- In addition to motivational parameters of the proposed system will improve the efficiency of the organization of production and labor process, all categories of workers in the enterprise.

On the basis of the findings raised the problem of a low degree of effectiveness of existing incentive systems of main and auxiliary staff of the production company.

To improve the efficiency of the process of motivation, increase the efficiency of production, the labor process is necessary to create a system of incentives, which will generate clear links pay levels with the level of production of industrial enterprises, the quality of products, the level of capacity utilization.

This technique can be applicable to any similar categories of employees and is universal, allows to approach methodically actions of rationing and the organization of customer services work, however even in the presence of all norms developed with the above-stated recommendations directly at the enterprise the constant control over their performance, updating, the analysis of a situation is necessary that will allow to draw long-term and system conclusions about quality of the established norms and quality of work in general.

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