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Accurate Standard Costs for Foundry Labor and Overhead

J. Louis Wargo

Foundries traditionally use cost per pound in setting up their budgets. This is convenient but quite unreliable if product mix varies sharply. The author suggests using time and unit measurements for —

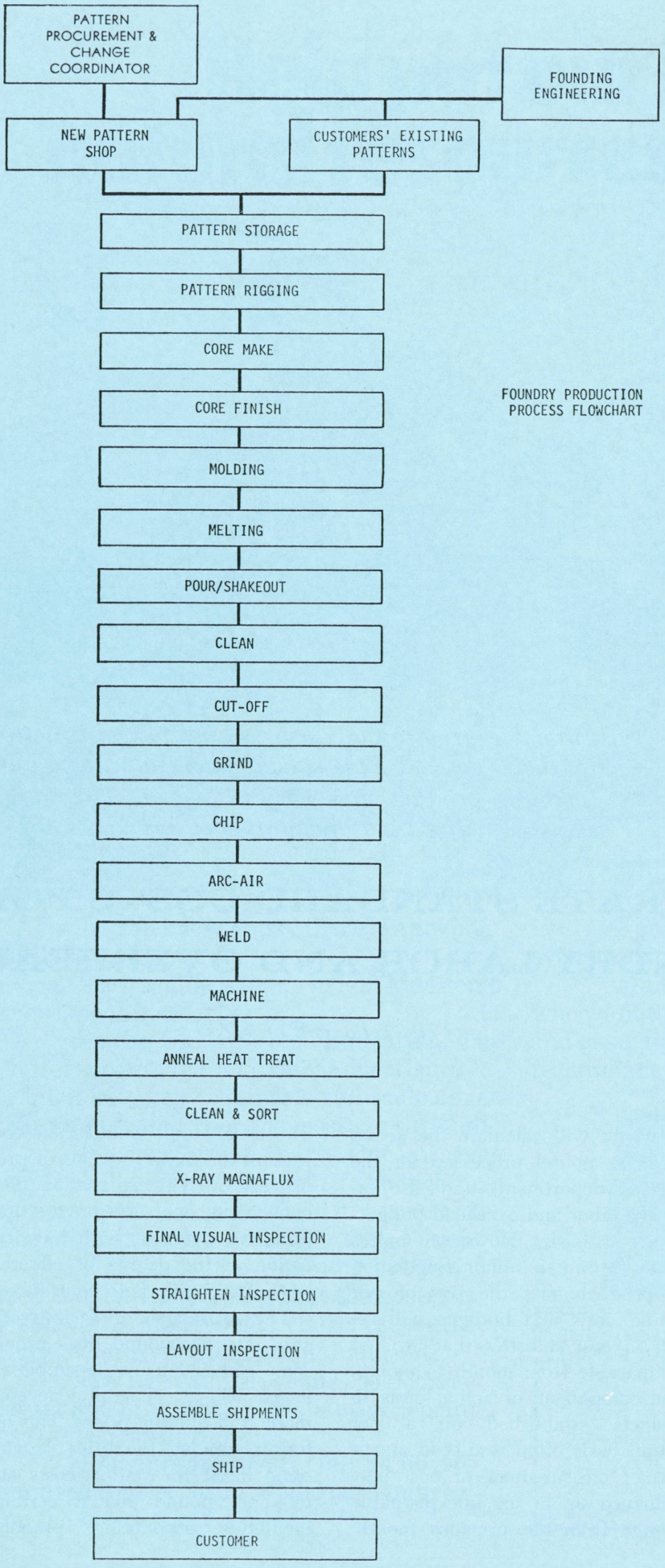
ACCURATE STANDARD COSTS FOR FOUNDRY LABOR AND OVERHEAD

by J. Louis Wargo
Ernst & Ernst

THE PRIMARY purpose of a standard cost accounting system is (1) to assist management in establishing selling prices, (2) to provide a convenient method of valuing inventory, and (3) to provide a means of controlling the cost of operations.

Foundry product costs and prices have historically been expressed in terms of pounds of castings. This general use of a cost per pound appears to have resulted in the misconception that foundry costs are actually incurred at a rate per casting pound. Consequently, many foundries will calculate the actual cost per pound processed for the various departments and also establish labor and overhead budgets on that basis. However, unless there is only a minor fluctuation in product mix, the use of per pound costs and budgets will result in cost statistics that are not comparable from month to month. The comparison of actual costs to budgets established on a per pound basis often results in an incorrect measurement of cost performance or in an unexplainable change from the previous month. The usual result would then be to explain the trend in terms of product mix. Such an explanation, while convenient, does not provide operating management with any indication of the degree of effectiveness of their efforts to control costs.

The expression of casting costs at a rate per pound does provide some convenience: it is simple and it is also a generally accepted method of quoting prices. This uniformity among foundries provides some merit for stating costs at a rate per pound and it certainly facilitates accounting practices.



FOUNDRY PRODUCTION PROCESS FLOWCHART

However, the desirability of stating costs on a per pound basis should not preclude the statement of labor and overhead costs in terms that are more meaningful to foundry supervision. This is especially true in establishing standard costs. Realistically, standards for the various operations should be established on a unit of measure, such as pieces or hours. If it is desirable, this standard can then be restated on a cost per pound basis.

In establishing standard costs for labor and overhead, primary consideration should be given to the specific operations that are to be measured and to providing such measurements to foundry supervision. The various foundry operations should be reviewed to determine if casting weight is the most equitable method of establishing standards and generating budgets.

Background

Although castings differ drastically in their size, shape (design), and weight, their production involves the use of similar operating practices. A small intricate casting weighing a pound or less may require the same operations as a large simple casting of 1,000 pounds. These essential operations are pattern making, melting, sand mixing, molding, core-making, cleaning or finishing, and heat treating. The operations performed on these dissimilar castings may be comparable, while the facilities and the operating time (and thus the cost) may differ drastically. For example, molding facilities may include bench molding, sand slinging, or shell making; core-making may include core-blowing, manual core-making, or core assembly; cleaning may include burning, chipping, grinding, shot blasting, or fumbling; heat treating may include an annealing furnace, oil quench, or special heat treatment. Various combinations of these possibilities can be involved in the production of a casting.

Since most foundry cost accounting systems are not designed to

provide the cost of each of these operations, an average cost of all castings produced is frequently used. With the wide variations in the physical dimensions of castings, weight was selected as the common denominator. The rationalization of the use of an average cost per pound was that casting costs that were overstated would be offset by casting costs that were understated. As long as customers' orders reflected a constant product mix this theory would hold up. With the competition in the industry, however, specific foundries have found that they are obtaining unprofitable orders and are losing the profitable orders.

Alternatively, production of small complex castings that may be marginally profitable when done in conjunction with the production of large simple castings becomes definitely unprofitable if the demand for the larger castings ceases, while production must go on with the smaller units.

In making this cost determination it will be generally established that another unit of measure, such as time or pieces, is more important than cost per pound to various areas. For example, in the melting furnace area the department head is mainly concerned with furnace hours and pounds of hot metal produced. Similarly, the core-making supervisor is concerned with the number of cores that are produced; the molding supervisor is concerned with molding equipment hours and flasks molded; the heat treating supervisor is concerned with furnace hours and the number of castings heat treated; and the sand mixer supervisor is concerned with the number of batches produced.

These department heads are only indirectly concerned with the weight of the castings to be produced as a result of their individual efforts. Accounting data, especially standard costs, for these areas should be expressed in a manner that is readily interpreted by the head of the department that is being measured.

EXHIBIT I

Example:
Cost Center 0100—Electric Furnace
Budget Determinant: Furnace Operating Hour
Normal Per Month: 519 Hours (3 shifts, 5 days/week)

CODE	EXPENSE DESCRIPTION	UNITS PER FURNACE HOUR	DOLLARS PER UNIT	STANDARD COST PER FURNACE HOUR
101	Direct Labor	5.0 hours	$4.40	$ 22.00
102	Indirect Labor	3.0 hours	3.20	9.60
200	Fringe Benefits	8.0 hours	1.275	10.20
300	Operating Supplies	—	—	14.30
400	Utilities	—	—	22.00
501	Maintenance Shop Labor	1.00	8.60	8.60
502	Maintenance Material	—	—	4.30
600	Lift Truck Service	—	—	7.00
700	Locomotive Engine Service	—	—	4.00
801	Laboratory Service	—	—	8.00
809	General Expenses	—	—	15.50
			TOTAL	$125.50

Dollar rates

To the extent practicable, standard cost rates for labor and overhead should be stated and budgeted as the cost of utilizing men or equipment for a given time period or as the cost of producing a specified quantity of product or other measurable items. Such a standard would, for example, indicate the cost to operate a melting furnace for an hour, the cost to produce 100 specified cores, the cost to operate a sand mixer for an hour, the cost to operate molding equipment for an hour, or the cost to grind or finish 100 specified castings. These labor and overhead standards should detail to the extent desirable the various elements of labor and overhead. See Exhibit 1, above.

Standard cost rates should similarly be established for the various cost centers on the basis of the most applicable budget determinants. The recommended method of developing such standard overhead rates is the demonstrated best method for a representative period.

Prior to developing overhead standards, it should be established that the reporting of the actual quantities is readily available for the preparation of performance reports. The availability of actual quantities for generating monthly standard cost budgets can be readily determined by a review of the present reporting system. Usually these quantities are being reported for payroll incentives, quality control, production control, inventory control, or departmental efficiency or control purposes. In those cases where data are not currently available, present reports should be revised to include such quantities. A list similar to Exhibit 2, on page 22, should be prepared to determine that the necessary information will be available for all cost centers.

The use of labor and overhead standards based on a unit of time requires the establishment of a production standard in order to convert these standard costs to a standard cost of producing a casting. Production standards are time allowances to produce or process a specified number of units, pounds, or pieces. These quantities should be related directly to the specific

J. LOUIS WARGO, CPA, is a manager in the Cleveland office of Ernst & Ernst. Previously he held various positions with United States Steel. Mr. Wargo is vice president of the Cleveland Chapter of the National Association of Accountants and a past president of the Downtown Club of Toastmasters International. He is a member of the Ohio Society of CPAs and the Greater Cleveland Growth Association. Mr. Wargo is a graduate of Geneva College.

casting. Some examples of this are shown in Exhibit 3, below.

Production standards should be stated in terms of elapsed time, as compared to payroll incentive times, so as to eliminate the calculations required to convert to real time and to facilitate a comparison to actual time. This is especially true in those areas where standard overhead cost rates have been established on the basis of machine or equipment hours instead of labor hours, e.g., melting furnace, heat treating furnace, molding hour, etc. For areas such as these that also have varying crew sizes it is difficult to have a common denominator other than elapsed time for production standards.

Incentive time standards generally result in "earned man hours" in excess of the actual hours worked with labor performances expressed accordingly. Under such incentive plans it is not unusual for employees to "earn" ten or more hours per eight hour working day. Since "earned man hours" must be converted to obtain loan standards, the use of production standards based on elapsed time will permit a projection of the production volume necessary to attain a specified production performance. This will facilitate the development of effective production and inventory control techniques.

EXHIBIT 2

COST CENTER		BUDGET DETERMINANT	PRODUCTION	
NUMBER	DESCRIPTION	DESCRIPTION	STANDARD	SOURCE
0100	Electric furnace	Earned* furnace operating hour	Pounds of hot metal poured	Melting furnace report
0210	Core-making	Earned man hour	Cores produced by core number	Incentive report
0320	Shot blaster	Earned shot blaster operating hour	Castings blasted by pattern number	Inspection report

* An earned hour is the time required to perform the necessary operations or produce a specified quantity of product.

EXHIBIT 3

COST CENTER	STANDARD DOLLAR RATE LABOR AND OVERHEAD	PRODUCTION STANDARD
Melting	Standard furnace operating hour	Pounds of Hot Metal/Hour
Molding	Standard molding equipment operating hour	Molds/Hour
Core-making	Standard man hour	Cores/Man Hour
Shot blaster	Standard shot blaster operating hour	Casting Blasted/Hour
Finishing	Standard grinder man hour	Man Hours/Casting

EXHIBIT 4

Example of Production Standards:
Cost Center: 0230 Molding

PATTERN NUMBER	PART NUMBER	WEIGHT PER CASTING	STANDARD RUN SIZE	EFFECTIVE DATE HOURS/ PER SETUP	EFFECTIVE DATE HOURS PER PIECE SETUP	EFFECTIVE DATE HOURS PER PIECE RUN
BE 165	3012-6021	82.5	350	1.50	.004	.158
BE 168	3012-6022	52.5	500	2.48	.005	.086
BE 179	3012-6023	50.5	500	2.47	.005	.094
BE 189	3012-6024	62.0	400	2.53	.006	.156
BY 140	3022-6121	61.5	400	2.51	.006	.160
BY 145	3022-6122	57.5	350	2.55	.007	.164
BY 155	3022-6123	57.5	350	2.59	.007	.168
BY 160	3022-6124	66.5	450	3.19	.007	.170
BZ 110	4012-1001	67.0	450	1.48	.003	.160
BZ 112	4012-1002	41.0	500	1.56	.003	.180

Source of standards

Production standards can be based upon incentive standards, other time study data, historically developed data, or even estimates. These standards may include an allowance for setup time where applicable or separate setup standards may be established. The principal advantage of a combined rate including run time and setup time is simplicity. Since the standard time is combined, it is unnecessary to report the actual time separately. The separation of run time and setup time will provide a means of measuring the performance of both areas and thus enhance the control of both areas. Inclusion of setup time with the production or run time standards may be done on a percentage basis or it may be a separately developed rate that is merely added to the production time. A specific setup time standard requires the establishment of a standard run size, so that the related costs can be expressed on a per piece basis. An example of production standards is shown in Exhibit 4, at the left.

The establishment of production standards not only enables the development of standard product costs but also facilitates the preparation of costs performance re-

EXHIBIT 5

STANDARD PRODUCT COST

Casting Weight: 825
Run Size: 350

Part Number: 3012-6021
Engineering Part Number: BE 165
Part Name: Manit

COST CENTER CODE	COST CENTER DESCRIPTION	WEIGHT OR MACHINE NUMBER	INCENTIVE STANDARD*	INCENTIVE TO ACTUAL FACTOR	STANDARD UNITS	CHARGING RATE	STANDARD COST
	Material	111.0			1.8270	.019	$ 3.82
	Scrap credit				.7770	.018	1.43 Cr.
	Net material						2.39
0220	Sand mixer	966	5.167	.865	4.469	13.20	.59
0210	Core room	117	30.667	.843	25.852	10.40	2.70
	Setup	117	.667	1.409	.940	7.20	.20
0230	Molding	104	15.833	.805	12.745	17.30	2.21
	Setup	104	1.500	.927	1.391	9.30	.37
0100	Electric furnace	109	11.000	.754	8.294	125.50	9.87
0310	Grinding	114	11.667	.816	9.520	8.40	.79
0320	Shot blast	106	3.333	.786	2.620	17.60	.45
0330	Cleaning	978	10.000	.801	8.010	17.80	1.42
0410	Testing	113	5.500	1.000	5.500	11.20	.61
	Setup	113	.667	1.000	.667	7.10	.13
					TOTAL COST PER CASTING		$21.73
					TOTAL COST PER POUND		$ .263

*Run time standard per 100 pieces. Setup standard per setup.

ports. A typical product cost for a casting might appear as in Exhibit 5, above.

Performance reports

The use of production standards permits the preparation of production performance reports that compare actual times with standard times. These comparisons can be by cost center, product group, or individual castings. The degree of refinement is dependent upon the detail in which actual times are available. Since standard times are related to specific castings that are usually identified in detail, reports can be prepared by shift, day, week, or any other time period. Typical performance reports might appear as shown in Exhibit 6, at the right.

Summary

The principal advantage of stating labor and overhead costs and budgets on a per pound basis is convenience. It is also a relatively simple method that spreads costs over a broad common denominator. The expression of standard costs for finished castings on the same basis is desirable; however, such costs should be derived from a more specific budget determinant, such as machine hours, and then converted to an expression per pound. This will permit the development of flexible budgets and product costs that more closely approximate actual costs. Such an approach requires the establishment of production standards to enable the conversion of dollar standards per unit of time to standard costs per casting. The use of production standards will facilitate the calculation of flexible budgets that are directly related to actual production and the preparation of reports for such flexible budgets. Use of these reports and standards by the management accountant will enable him to function more effectively in the management of the foundry.

EXHIBIT 6

PRODUCTION PERFORMANCE

Plant: Cleveland — Week Ending: 11-30-71

COST CENTER	PER CENT PERFORMANCE	STANDARD HOURS	ACTUAL HOURS	VARIANCE HOURS
0100 Electric furnace	104	119.6	115.0	+ 4.6
0210 Core-making	95	760.0	800.0	—40.0
0220 Sand mixer	97	116.4	120.0	— 3.6
0310 Shake out	100	120.0	120.0	—
0320 Hand chipping	105	420.0	400.0	+20.0

PRODUCTION PERFORMANCE

Cost Center: Molding — Week Ending: 11-30-71

PATTERN NUMBER	PART NUMBER	QUANTITY	STANDARD	ACTUAL	VARIANCE	PER CENT PERFORMANCE
BE 165	3012-6021	400	63.2	55.0	+ 8.2	114.9
BE 168	3012-6022	500	43.0	40.0	+ 3.0	107.5
BE 189	3012-6024	500	78.0	75.0	+ 3.0	104.0
BY 145	3022-6122	300	49.2	52.0	— 2.8	94.6
BY 155	3022-6123	450	76.0	70.0	+ 6.0	108.5
BY 160	3022-6124	400	68.0	65.0	+ 3.0	104.6
BZ 112	4012-1002	500	90.0	88.0	+ 2.0	102.0
		TOTAL	467.4	445.0	+22.4	105.0