# C BEAMA Standard Formulae

## Symbols and Definitions

| Symbol | Description |
|---|---|
| **BEL** | BEAMA Electrical Labour Cost Index |
| **BML** | BEAMA Mechanical Labour Cost Index |
| **BEE** | BEAMA Basic Electrical Equipment Cost Index |
| **BMM** | BEAMA Mechanical Engineering Cost Index |
| **BFB** | BEAMA Factory Built Assemblies Cost Index |
| **BDT** | BEAMA Distribution Transformer Cost Index |
| **BIE** | BEAMA Industrial Electronic Cost Index |
| **BLT** | BEAMA Large Power Transformer Index |
| **BIS** | BEAMA Basic Iron & Steel Cost Index |
| **BIP** | BEAMA Basic Iron & Steel Producers Cost Index |
| **LMEcu** | London Metal Exchange (www.lme.com) settlement price of copper grade A |
| **TDEgoes** | Price Index of materials for Grain Oriented Electrical Steel (GOES) published on the T&D Europe website (www.tdeurope.eu) |
| **TDEoil** | Price Index of materials for Insulating Oil published on the T&D Europe website (www.tdeurope.eu) |
| $P_0$ | Initial Contract Price (FOB price for export contracts) |
| $P_n$ | Final Contract Price (FOB price for export contracts) |
| $I_0$ | Index value last published before date of Tender |
| $I_n$ | Index value last published before the completion date |
| $I_{avg\|t:x-y}$ | Average of Index (or Price) $I$, published between $x$% and $y$% of the contract period |
| $I_{avg\|mth:x,y,z}$ | Average of Index (or Price) $I$, published for months of $x, y$ & $z$ after the contract start date ($I_{avg\|mth:n-x,n-y,n-z}$ is the average of $I$ published for months of $x, y$&$z$ before the completion date ). |
| $I_{mth:0+x}$ | Index (or Price) of $I$ published $x$ months after the date of Tender. ( $I_{mth:0}$ = published in month in which Tender date falls ; $I_{mth:0-2}$ = Index of $I$ published 2 months before date of Tender; $I_{mth:n-x}$ = published $x$ months before the completion date) |
| $I_{day:x}$ | Index (or Price) published $x$ days from the date of Tender. ( $I_{day:0}$ = published on the same day as the date of Tender ; $I_{day:0-2}$ = published 2 days before date of Tender) |
| $I_{date:agreed}$ | Index (or Price) of $I$ published on the $date$ specified in advance by the Purchaser and $agreed$ by the Contractor |
| $I_{date:order}$ | Index (or Price) of $I$ published on the $date$ the Contractor places the $order$ with the supplier |

## C.1 Electrical Machinery

$$P_n = \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEE_{avg|t:40-80}}{BEE_0} + 47.5 \times \frac{BEL_{avg|t:33-100}}{BEL_0}\right)$$

## C.2 Mechanical Plant

$$P_n = \frac{P_0}{100}\left(5 + 47.5 \times \frac{BMM_{avg|t:40-80}}{BMM_0} + 47.5 \times \frac{BML_{avg|t:33-100}}{BML_0}\right)$$

## C.3 Industrial Electronic Equipment

$$P_n = \frac{P_0}{100}\left(5 + 32 \times \frac{BIE_{avg|t:40-80}}{BIE_0} + 63 \times \frac{BML_{avg|t:33-100}}{BML_0}\right)$$

## C.4 Rotating Electrical Machinery

$$P_n = \frac{P_0}{100}\left(5 + 40 \times \frac{BEE_{avg|t:58-75}}{BEE_0} + 55 \times \frac{BEL_{avg|t:58-100}}{BEL_0}\right)$$

## C.5 Distribution Transformers $<$ 10 MVA

$$\begin{aligned} P_n &= \frac{P_0}{100}\left(5 + 35 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + x \times \frac{BLT_{mth:n-2}}{BLT_{mth:0}} + y \times \frac{LMEcu_{date:agreed}}{LMEcu_{day:0}}\right) \\ x + y &= 60 \end{aligned}$$

$y$ is the proportion of the contract price at the date of tender wholly related to copper (i.e. the weight of copper multiplied by the cost per kilo of copper at tender date, expressed as proportion of the contract price at date of tender. This proportion should be scaled down by 60% to preserve the material proportion of the formula.)

## C.6 Distribution Transformers $\geq$ 10 MVA

$$\begin{aligned} P_n &= \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + x \times \frac{BLT_{mth:n-2}}{BLT_{mth:0}} + y \times \frac{LMEcu_{date:agreed}}{LMEcu_{day:0}} + z \times \frac{TDEoil_n}{TDEoil_0}\right) \\ x + y + z &= 47.5 \end{aligned}$$

$y$ is the proportion of the contract price at the date of tender wholly related to copper (the weight of copper multiplied by the cost per kilo of copper at tender date, expressed as proportion of the contract price at date of tender).

$z$ is the proportion of the contract price at date of tender which is wholly related to insulating oil (i.e. the quantity of insulating oil multiplied by the cost per litre of insulating oil at tender date, expressed as a proportion of the contract price at date of tender).

## C.7 Large Power Transformers

$$\begin{aligned} P_n = \frac{P_0}{100}\Big(5 &+ 25 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + 20 \times \frac{BLT_{mth:n-2}}{BLT_0} + 10 \times \frac{BIS_{mth:n-2}}{BIS_0} \\ &+ 15 \times \frac{LMEcu_{order|day:1}}{LMEcu_{day:0}} + 5 \times \frac{TDEoil_{n-2}}{TDEoil_{mth:0-1}} + 20 \times \frac{TDEgoes_{n-2}}{TDEgoes_{mth:0-1}}\Big) \end{aligned}$$

## C.8 Turbo Generating & Allied Plant

$$P_n = \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEL_{avg|t:33-100}}{BEL_0} + 33.25 \times \frac{BIS_{avg|t:40-80}}{BIS_0} + 14.25 \times \frac{BMM_{avg|t:40-80}}{BMM_0}\right)$$

## C.9 Distribution Feeder Pillars

$$P_n = \frac{P_0}{100}\left(5 + 56 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0-1}} + 39 \times \frac{BEE_{mth:n-1}}{BEE_{mth:0-1}}\right)$$

## C.10 Switchgear $\leq 36kV$

$$P_n = \frac{P_0}{100}\left(5 + 45 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + 50 \times \frac{BEE_{mth:n-1}}{BEE_{mth:0-1}}\right)$$

## C.11 Switchgear $> 36kV$

$$P_n = \frac{P_0}{100}\left(5 + 45 \times \frac{BEL_{avg|mth:n-3,n-2,n-1}}{BEL_{mth:0}} + 50 \times \frac{BEE_{avg|mth:n-4,n-3}}{BEE_{mth:0}}\right)$$

## C.12 Factory Built Assemblies for Control Equipment

$$P_n = \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + 47.5 \times \frac{BFB_{mth:n-1}}{BFB_{mth:0}}\right)$$

## C.13 Factory Built Assemblies for Low Voltage Switchgear

$$P_n = \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + 47.5 \times \frac{BEE_{mth:n-1}}{BEE_{mth:0}}\right)$$

## C.14 Service and Maintenance (Electrical)

$$\begin{aligned} P_n &= \frac{P_0}{100}\left(5 + x \times \frac{BEL_{mth:n-1}}{BEL_{mth:0}} + y \times \frac{BEE_{mth:n-1}}{BEE_{mth:0}}\right) \\ 95 &= x + y \end{aligned}$$

## C.15 Service and Maintenance (Mechanical)

$$\begin{aligned} P_n &= \frac{P_0}{100}\left(5 + x \times \frac{BML_{mth:n-1}}{BML_{mth:0}} + y \times \frac{BMM_{mth:n-1}}{BMM_{mth:0}}\right) \\ 95 &= x + y \end{aligned}$$

## C.16 Electrical / Mechanical Contracts

$$P_n = \frac{P_0}{100}\left(5 + 23.75 \times \frac{BEE_{avg|t:40-80}}{BEE_0} + 23.75 \times \frac{BEL_{avg|t:33-100}}{BEL_0} + 23.75 \times \frac{BMM_{avg|t:40-80}}{BMM_0} + 23.75 \times \frac{BML_{avg|t:33-100}}{BML_0}\right)$$

# D Worked Example: Electrical Machinery

## D.1 Standard Formula

If the cost to the Contractor of performing his obligations under the Contract shall be increased or reduced by reason of any rise or fall in labour costs or in the cost of material the amount of such increase or reduction shall be added to or deducted from the Contract Price as the case may be. Provided that no account shall be taken of any amount by which any cost incurred by the Contractor has been increased by the default or negligence of the Contractor.

Variations in the cost of materials and labour shall be calculated in accordance with the following Formula:

$$P_n = \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEE_{avg|t:40-80}}{BEE_0} + 47.5 \times \frac{BEL_{avg|t:33-100}}{BEL_0}\right) \quad (1)$$

| | |
|---|---|
| $P_n$ | Final Contract Price (*FOB price for Export Contracts*) |
| $P_0$ | Contract Price at Date of Tender (*FOB price for Export Contracts*) |
| $BEE_{avg\|t:40-80}$ | Average of BEAMA Electrical Equipment index last published at *two-fifths* point of the Contract Period and ending with the Index last published before the *four-fifths* point of the Contract Period. |
| $BEE_0$ | BEAMA Electrical Equipment Index figure last published before the date of tender. |
| $BEL_{avg\|t:33-100}$ | Average of the BEAMA Labour Cost index figures for Electrical Engineering published for the last *two-thirds* of the Contract Period. |
| $BEL_0$ | The BEAMA Labour Cost index figure for Electrical Engineering published for the month in which the tender date falls. |

## D.2 Data

- **A** - Contract Price, $P_0 =$ £20,000
- **B** - Date of Tender, $T_0 =$ 20TH JAN 2005
- **C** - Date of Order, $T_1 =$ 14TH FEB 2005
- **D** - Completion Date, $T_2 =$ 12TH AUG 2008

## D.3 Calculation

### D.3.1 Contract Days

- **E** - Contract days between **C** and **D**, $\Delta T = T_2 - T_1 = 1275$

### D.3.2 Electrical Material Indices (2000=100)

- **F** - Date at two-fifths of Contract Period, $T_{40\%} = T_1 + \frac{2}{5}\Delta T = T_1 + 510(days)$ = (09/Jul/06)
- **G** - Date at four-fifths of Contract Period, $T_{80\%} = T_1 + \frac{4}{5}\Delta T = T_1 + 1020(days)$ = (01/Dec/07)
- **H** - Average of indices published between **F** & **G**, $BEE_{avg|t:40-80}$ = average(issue441 to issue459) = 135.87
- **I** - Index last published before the date of tender **B**, $BEE_0$ = issue425 = 113.3

### D.3.3 Electrical Labour Indices (Jan 1980=100)

- **J** - Date at one-third of Contract Period, $T_{33\%} = T_1 + \frac{1}{3}\Delta T = T_1 + 425(days)$ = (15/Apr/06)
- **K** - Completion date, $T_{100\%} = T_2$ = (12/Aug/08)
- **L** - Average of indices published between **J** & **K**, $BEL_{avg|t:33-100}$ = average(issue439 to issue467) = 702.06
- **M** - Index published for the month in which the tender date falls **B**, $BEL_0$ = issue424 = 640.2

### D.3.4 Final Contract Price

$$
\begin{aligned}
P_n &= \frac{P_0}{100}\left(5 + 47.5 \times \frac{BEE_{avg|t:40-80}}{BEE_0} + 47.5 \times \frac{BEL_{avg|t:33-100}}{BEL_0}\right) && (2)\\
&= \frac{20000}{100}\left[5 + 47.5 \times \frac{135.87}{113.30} + 47.5 \times \frac{702.06}{640.20}\right] && (3)\\
&= 22,810.00 && (4)
\end{aligned}
$$

### D.3.5 Price Adjustment

$$
\begin{aligned}
\Delta P &= P_n - P_0 && (5)\\
&= 22,810.00 - 20,000.00 && (6)\\
&= 2,810.00 && (7)
\end{aligned}
$$