Lifetime Performance Index (LPI) Formula
- April 2016 -

$$\text{LPI} = \left[\begin{array}{c} \text{Production Component} \times \text{Emphasis} \times \text{Factor} \end{array} + \begin{array}{c} \text{Durability Component} \times \text{Emphasis} \times \text{Factor} \end{array} + \begin{array}{c} \text{Health \& Fertility Component} \times \text{Emphasis} \times \text{Factor} \end{array} \right] + \text{Constant}$$

Where the relative emphasis placed on each of the three main components in each breed is presented in the following table along with the multiplicative factors for each component.

Breed	LPI Constant	Production		Durability		Health & Fertility	
		Emphasis	Factor	Emphasis	Factor	Emphasis	Factor
Ayrshire	1903	50	.5893	31	.6991	19	.8832
Brown Swiss	890	50	.6030	30	.7371	20	.9748
Canadienne	940	48	.5211	32	.8032	20	.8061
Guernsey	641	50	.5425	30	.7026	20	.7294
Holstein	1892	40	.5568	40	.7327	20	.6908
Jersey	1022	57	.6862	33	.7228	10	.6907
Milking Shorthorn	1061	54	.5500	31	.7916	15	1.2729

Production Component (PROD):

$$\text{PROD} = [W_{PY} \times (PY - Avg_{PY})/SD_{PY}] + [W_{PD} \times PD/SD_{PD}] + [W_{FY} \times (FY - Avg_{FY})/SD_{FY}] + [W_{FD} \times FD/SD_{FD}]$$

Where PY = Protein Yield, PD = Protein Deviation, FY = Fat Yield and FD = Fat Deviation, which are standardized using the appropriate averages (Avg) and standard deviations (SD) and then multiplied by their respective relative weight (W), all of which are breed specific as outlined in the following table.

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
EBV Averages	Milk Yield	-35	-85	-279	19	214	122	-128
	Fat Yield	-1	-2	-6	-1	8	7	-6
	Protein Yield	-1	-1	-5	0	8	5	-3
EBV Standard Deviations	Milk Yield	620	500	450	550	740	760	450
	Fat Yield	25	20	11	23	28	34	19
	Fat Deviation	.21	.20	.20	.27	.28	.38	.16
	Protein Yield	21	17	7	15	21	25	11
	Protein Deviation	.11	.12	.13	.10	.12	.16	.09
Relative Weights Within the Production Component	Fat Yield	4.0	3.8	4.0	3.8	4.0	2.8	3.6
	Fat Deviation		0.2		0.2		0.5	0.4
	Protein Yield	6.0	5.7	6.0	5.7	6.0	5.7	5.4
	Protein Deviation		0.3		0.3		1.0	0.6

Durability Component (DUR):

$$DUR = [W_{HL} \times (HL - 100)/5] + [W_{MS} \times MS/5] + [W_{F\&L} \times F\&L/5] + [W_{DS} \times DS/5] + [W_{RP} \times RP/5]$$

Where HL = Herd Life, MS = Mammary System, F&L = Feet and Legs, DS = Dairy Strength and RP = Rump, and each trait is standardized using the appropriate averages and standard deviations and then multiplied by their respective relative weight (W) that is breed specific as outlined in the following table.

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
Relative Weights Within the Durability Component	Herd Life	4.7	4.0	4.0	4.0	2.0	2.0	2.6
	Mammary System	3.1	3.2	3.2	3.2	4.0	4.0	4.0
	Feet & Legs	2.2	1.6	2.2	2.4	3.0	3.0	2.6
	Dairy Strength			0.6	0.4	1.0	1.0	0.8
	Rump		1.2					

Health & Fertility Component (H&F):

$$H\&F = [W_{DF} \times (DF-100)/5] + [W_{MR} \times (MR-100)/5] +$$

$$[W_{SCS} \times -1 \times (SCS-3.00)/0.23] + [W_{UD} \times UD/5] + [W_{MSP} \times (MSP-100)/5] + [W_{LP} \times (LP-100)/5]$$

Where DF = Daughter Fertility, MR = Mastitis Resistance, SCS = Somatic Cell Score, UD = Udder Depth, MSP = Milking Speed and LP = Lactation Persistency. The relative weights for each trait (i.e.: W_{DF}, W_{MR}, W_{SCS}, W_{UD}, W_{MSP} and W_{LP} respectively), which are specific to each breed, are provided in the following table.

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
Relative Weights Within the Health & Fertility Component	Daughter Fertility	5.3	4.0	5.0	6.7	6.7	3.0	2.0
	Mastitis Resistance	3.7				3.3	7.0	
	Somatic Cell Score		3.0	2.6	2.0			4.8
	Udder Depth		1.0	1.6	1.0			2.4
	Milking Speed	0.5	2.0	0.8	0.3			0.8
	Lactation Persistency	0.5						