



Lifetime Performance Index (LPI) Formula - April 2023 -

$$LPI = \left(\begin{array}{l} \text{Production} \\ \text{Component} \\ \text{x Emphasis} \\ \text{x Factor} \end{array} + \begin{array}{l} \text{Durability} \\ \text{Component} \\ \text{x Emphasis} \\ \text{x Factor} \end{array} + \begin{array}{l} \text{Health \&} \\ \text{Fertility} \\ \text{Component} \\ \text{x Emphasis} \\ \text{x Factor} \end{array} \right) + \text{Constant}$$

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	2019	46	.5681	32	.7170	22	.9592
Brown Swiss	966	55	.5458	27	.6835	18	.8328
Canadienne	932	55	.4480	30	.6537	15	.8387
Guernsey	648	50	.5547	35	.7406	15	.6895
Holstein	2255	40	.5420	40	.7971	20	.6869
Jersey	1088	50	.5979	30	.6281	20	.7645
Milking Shorthorn	1076	56	.5419	30	.8335	14	1.0332

Production Component (PROD):

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

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	-438	-293	-281	-256	-432	-208	-178
	Fat Yield	-21	-10	-6	-10	-26	-16	-13
	Protein Yield	-17	-10	-5	-9	-19	-11	-6
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	5.0	4.5	4.5	4.5	6.0	4.5	4.5
	Fat Deviation		0.5	0.5	0.5		0.5	0.5
	Protein Yield	5.0	4.5	4.5	4.5	4.0	4.5	4.5
	Protein Deviation		0.5	0.5	0.5		0.5	0.5

Durability Component (DUR):

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

Where HL = Herd Life, MS = Mammary System, F&L = Feet and Legs, HH = Hoof Health, 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	4.0	4.0	2.0	3.4	2.0	2.0	2.6
	Mammary System	3.8	3.2	5.5	3.2	3.7	4.0	4.0
	Feet & Legs	2.2	1.6	2.5	2.4	2.1	4.0	2.6
	Hoof Health					0.7		
	Dairy Strength				1.0	1.0		0.8
	Rump		1.2			0.5		

Health & Fertility Component (H&F):

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

Where DF = Daughter Fertility, MR = Mastitis Resistance, SCS = Somatic Cell Score, UD = Udder Depth, MSP = Milking Speed and MT = Milking Temperament. The relative weights for each trait (i.e.: W_{DF} , W_{MR} , W_{SCS} , W_{UD} , W_{MSP} and W_{MT} , 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	4.0	4.0	4.0	6.7	6.7	5.0	2.0
	Mastitis Resistance	1.0				3.3	5.0	
	Somatic Cell Score		3.0	3.0	2.0			4.8
	Udder Depth		1.0	2.0	1.0			2.4
	Milking Speed	3.0	2.0	1.0	0.3			0.8
	Milking Temperament	2.0						