

Use of WHFF Direct Test Codes for Coat Color:

To explain most of the color variations seen in Holsteins requires the use of two genes; the COPA gene, having 2 alleles, with the dominant allele coding for RED; and the MC1R gene, having 4 alleles, with the RED alleles being recessive. The dominant RED allele (D) from the COPA gene is epistatic to all of the MC1R alleles (E^D, E^{BR}, E^+, e).

Order of Dominance	D > E^D > E^{BR} > E⁺ > e
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Gene: COPA Common Name: Variant Red or Dominant Red			
Genotype for COPA gene	Phenotype	Designation in Name	WHFF Direct Test Codes
D D	Red		VRS
D d	Red		VRC
d d	Black		VRF
	Red	RED	VRR*
* Not genotyped, determined by pedigree			

The COPA gene masks the expression of MC1R gene so its phenotype is not expressed. An animal must have the genotype dd for the COPA gene in order for the MC1R genotypes to be expressed. Inheritance for MC1R is recessive.

Gene: MC1R Common Name: Traditional Red or Recessive Red			
Genotype for MC1R gene	Phenotype	Designation in Name	WHFF Direct Test Codes
$E^D E^D$	Black		BKS
$E^D E^{BR}$	Black		BRC BKC
$E^D E^+$	Black		RDC BKC
$E^D e$	Black		RDC BKC
$E^{BR} E^{BR}$	Black / Red		BRS
$E^{BR} E^+$	Black / Red		BRC RDC
$E^{BR} e$	Black / Red		BRC RDC
$E^+ E^+$	Red	RED	RDS
$E^+ e$	Red	RED	RDS
e e	Red	RED	RDS