SUMMARY AND TERMS

[06] The present disclosure relates to a first lubricating oil composition and method of operating a boosted internal combustion engine with the first lubricating oil composition, hereinafter referred to as Invention A, and a second lubricating oil composition and method of operating a boosted internal combustion engine with the second lubricating oil composition, hereinafter referred to as Invention B.

[06a] In one aspect, the present disclosure refers to a method for reducing or preventing formation of deposits in a boosted internal combustion engine comprising steps of:

lubricating a boosted internal combustion engine with a a lubricating oil composition comprising:

greater than 50 wt.% of a base oil of lubricating viscosity and metal-containing detergents comprising one or more overbased-calcium-containing detergents in an amount to provide from 1100 to 1700 ppm by weight calcium to the lubricating oil composition based on a total weight of the lubricating oil composition, wherein the one or more overbased-calcium-containing detergents have a total base number greater than 250 mg KOH/g, measured by the method of ASTM D-2896 and one or more low-based/neutral calcium-containing detergents having a TBN of up to 175 mg KOH/g, measured by the method of ASTM D-2896, and

one or more overbased-magnesium containing detergents in an amount sufficient to provide from 20 ppm by weight to 1500 ppm by weight magnesium to the lubricating oil composition, based on the total weight of the lubricating composition, wherein the one or more overbased-magnesium-containing detergents have a total base number greater than 250 mg KOH/g, measured by the method of ASTM D-2896;

wherein the lubricating oil composition has a total base number of at least 6.0 mg KOH/g of the lubricating oil composition, as measured by the method of ASTM D-2896;

the lubricating oil composition does not include overbased calcium salicylate detergents;

a ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total nitrogen in ppm in the lubricating oil composition is less than 1.9;

a ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total boron in ppm in the lubricating oil composition is less than 7.5;

a ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total molybdenum in ppm in the lubricating oil composition is less than 23.8; and

the lubricating oil composition has a NOACK volatility as measured by the method of ASTM D-5800 at 250 ^{o}C of less than 11.0 wt.%, and the lubricating oil composition is effective to ensure a TCO Temperature Increase of less than 9.0% as measured using the 2015 version of

the General Motors dexos1® Turbocharger Coking Test; and

operating the engine lubricated with the lubricating oil composition.

[07] INVENTION A

[08] In an embodiment of Invention A, the lubricating oil composition includes greater than 50 wt.% of a base oil of lubricating viscosity. The lubricating oil composition has a ratio of total metal from the one or more metal-containing detergent(s) in ppm in the lubricating oil composition to the total nitrogen in ppm in the lubricating oil composition of less than 1.9; a ratio of total metal from the one or more metal-containing detergent(s) in ppm in the lubricating oil composition to the total boron in ppm in the lubricating oil composition is less than 7.5; and a ratio of total metal from the one or more metal-containing detergent(s) in ppm in the lubricating oil composition to the total molybdenum in ppm in the lubricating oil composition is less than 23.8. In addition, the lubricating oil composition has a NOACK volatility as measured by the method of ASTM D-5800 at 250 ºC of less than 11.0 wt.%, and the lubricating oil composition is effective to ensure a TCO Temperature Increase of less than 9.0% as measured using the 2015 version of the General Motors dexos1® Turbocharger Coking Test (TC Test).

[09] In another embodiment of Invention A, the disclosure provides a method for reducing or preventing the formation of deposits in a boosted internal combustion engine. The method includes a step of lubricating a boosted internal combustion engine with a lubricating oil composition comprising greater than 50 wt.% of a base oil of lubricating viscosity. The lubricating oil composition has a ratio of total metal from the one or more metal-containing detergent(s) in ppm in the lubricating oil composition to the total nitrogen in ppm in the lubricating oil composition of less than 1.9; a ratio of total metal from the one or more metal-containing detergent(s) in ppm in the lubricating oil composition to the total boron in ppm in the lubricating oil composition is less than 7.5; and a ratio of total metal from the one or more metal-containing detergent(s) in ppm in the lubricating oil composition to the total molybdenum in ppm in the lubricating oil composition is less than 23.8. In addition, the lubricating oil composition has a NOACK volatility as measured by the method of ASTM D-5800 at 250 ºC of less than 11.0 wt.%. By lubricating a boosted internal

What is claimed is:

1. A method for reducing or preventing formation of deposits in a boosted internal combustion engine comprising steps of:

lubricating a boosted internal combustion engine with a lubricating oil composition comprising:

greater than 50 wt.% of a base oil of lubricating viscosity and metal-containing detergents comprising one or more overbased-calcium-containing detergents in an amount to provide from 1100 to 1700 ppm by weight calcium to the lubricating oil composition based on a total weight of the lubricating oil composition, wherein the one or more overbased-calcium-containing detergents have a total base number greater than 250 mg KOH/g, measured by the method of ASTM D-2896 and one or more low-based/neutral calcium-containing detergents having a TBN of up to 175 mg KOH/g, measured by the method of ASTM D-2896, and

one or more overbased-magnesium containing detergents in an amount sufficient to provide from 20 ppm by weight to 1500 ppm by weight magnesium to the lubricating oil composition, based on the total weight of the lubricating composition, wherein the one or more overbased-magnesium-containing detergents have a total base number greater than 250 mg KOH/g, measured by the method of ASTM D-2896;

wherein the lubricating oil composition has a total base number of at least 6.0 mg KOH/g of the lubricating oil composition, as measured by the method of ASTM D-2896;

the lubricating oil composition does not include overbased calcium salicylate detergents;

a ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total nitrogen in ppm in the lubricating oil composition is less than 1.9;

a ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total boron in ppm in the lubricating oil composition is less than 7.5;

a ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total molybdenum in ppm in the lubricating oil composition is less than 23.8; and

the lubricating oil composition has a NOACK volatility as measured by the method of ASTM D-5800 at 250 ºC of less than 11.0 wt.%, and the lubricating oil composition is effective to ensure a TCO Temperature Increase of less than 9.0% as measured using the 2015 version of the General Motors dexos1® Turbocharger Coking Test; and

operating the engine lubricated with the lubricating oil composition.

2. The method according to claim 1, wherein the ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total nitrogen in ppm in the lubricating oil composition is less than 1.8, or

the ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total boron in ppm in the lubricating oil composition is less than 7.3, or

the ratio of total metal from the metal-containing detergents in ppm in the lubricating oil composition to the total molybdenum in ppm in the lubricating oil composition is less than 20.0.

3. The method according to claim 1, wherein the lubricating oil composition,

has a total nitrogen amount of 900 ppm by weight to 1600 ppm by weight; or has greater than 50 ppm by weight to 1000 ppm by weight of boron from one or more borated compound(s); or

has 80 ppm by weight to 1200 ppm by weight molybdenum from an oil soluble molybdenum compound.

4. The method according to claim 1, wherein the lubricating oil composition has a NOACK volatility as measured by the method of ASTM D-5800 at 250 ^{o}C of 2.0 wt.% to less than 11.0 wt.%.

5. The method according to claim 1, wherein the lubricating oil composition is effective to ensure a TCO Temperature Increase of less than 8.0% as measured using the 2015 version of the General Motors dexos1® Turbocharger Coking Test.

6. The method according to claim 1, wherein the lubricating oil composition has an 0W-20 rating.