2. A process as set forth in claim 1 wherein said existing interpass absorber had been constructed for operation at a mass flow ratio of sulfuric acid absorption liquid to gas between about 6 and about 10 at a gas strength of between about 7% and about 12% by volume SO_3.

3. A process as set forth in either claim 1 or 2 in which said source of sulfur comprises elemental sulfur.

4. A process as set forth in claim 3 wherein the conversion gas entering the primary absorption zone contains at least about 0.60 moles~~, at least about 0.70 moles, at least about 0.80 moles, at least about 0.90 moles, or at least about 0.95 moles~~ water per mole total equivalent sulfur oxide content of the gas prior to entry into the absorption zone.

5. A process as set forth in claim 3 wherein sulfur is burned in a dry gas comprising excess oxygen to produce said sulfur oxide-bearing gas stream comprising a combustion gas comprising sulfur dioxide and oxygen.

6. A process as set forth in claim 3 wherein water vapor is introduced into the SO_3-bearing conversion gas upstream of the primary absorption zone with respect to the direction of gas flow in a proportion sufficient to increase the equivalent water vapor content of the gas to at least about 0.55 moles~~, at least about 0.60 moles, at least about 0.70 moles, at least about 0.80 moles, at least about 0.90 moles, or at least about 0.95 moles~~ per mole total equivalent SO_3 content of the gas prior to entry into the absorption zone.

7. A process as set forth in claim 6 wherein water vapor is introduced into the sulfur oxide-bearing gas upstream of the primary absorption zone with respect to the direction of gas flow in a proportion sufficient to increase the equivalent water vapor content of the gas to between about 0.80 moles and about 1.00 moles per mole equivalent SO_3 content of the gas prior to entry into the primary absorption zone.

8. A process as set forth in claim 6 wherein water vapor is introduced into the sulfur oxide-bearing gas upstream of the primary absorption zone with respect to the direction of gas flow in a proportion sufficient to provide a sulfuric acid vapor content

of at least at least about 0.25 moles~~, or at least about 0.30 moles or at least about 0.35 moles~~ per mole sulfur trioxide in the conversion gas entering the primary absorption zone.

9. A process as set forth in claim 6 wherein the temperature of the gas entering the primary absorption zone is at least 55°C above its dew point and the dew point of the gas stream is not more than 25°C above the temperature of the acid with which it comes into contact at the gas inlet to said primary absorption zone.

10. A process as set forth in claim 6 wherein the concentration of the acid entering the primary absorption zone is between about 99.0 and about 99.6%.

11. A process as set forth in claim 6 wherein the temperature of the acid exiting the secondary absorption zone is no more than about 35°C cooler or no more than 30°C cooler than the gas entering the secondary absorption zone.

12. A process as set forth in claim 6 wherein the concentration of the acid exiting the secondary absorption zone is between about 99.2 and 99.5%.

13. A process as set forth in claim 6 wherein the molar ratio of H_2SO_4 vapor to SO_3 in the gas exiting the primary absorption zone is between about 1.5 and about 3.0.

14. A process as set forth in claim 6 wherein water vapor is introduced into said conversion gas in a water vapor injection zone upstream of said primary absorption zone and the conversion gas is introduced into the primary absorption zone without intermediate condensation of any component of the sulfur oxide-bearing gas stream between said water vapor injection zone and said primary absorption zone.

15. A process as set forth in claim 6 wherein heat generated by reaction of sulfur trioxide and water, condensation of sulfuric acid, and/or absorption of sulfur trioxide into the absorption liquid is transferred to a heat transfer fluid in a quantity of at least about 1160 KJ per Kilogram of equivalent SO_3 (500 Btu per pound of

23. A process as set forth in claim 21 wherein the combination of the flow rate and temperature of undeaerated water entering said deaerator and the rate of heat transfer from said auxiliary absorption liquid to said water stream in said deaerator auxiliary heat exchanger is such that the mass flow ratio of deaerated boiler feed water exiting said deaerator to equivalent sulfur trioxide entering said primary absorption zone is at least about 1.0~~, preferably at least about 1.5, more preferably at least about 2.0, typically between about 2.0 and about 3.0~~.

24. A process as set forth in claim 6 wherein the absorption liquid is circulated from said primary absorption zone to an external heat exchanger for removal of the heat of absorption, and net sulfuric acid produced in the primary absorption zone is removed as a product stream from the circulating acid, the rate of removal of product acid and the rate of circulation of absorption liquid relative to the flow of sulfur trioxide into the primary absorption zone being controlled to maintain the sulfuric acid concentration of the absorption liquid at a value that does not differ from the azeotrope by more than +1.0 wt.% throughout said primary absorption zone, or does not vary by less than -0.2 wt.% nor more than +0.8 wt.% at any location within the primary zone.

25. A method for retrofitting an existing contact sulfuric acid plant comprising an interpass absorber for recovery at high temperature of the heat of absorption of SO_3 in sulfuric acid, the method comprising:

installing a new absorber for receiving converter gas comprising sulfur trioxide, said new absorber comprising a primary absorption zone designed for high temperature absorption of SO_3 in a primary absorption liquid comprising sulfuric acid to produce additional sulfuric acid therein;

installing a high temperature heat exchanger designed for transfer of the heat of SO_3 absorption from said primary absorption liquid to another fluid and thereby heat the other fluid to a temperature of at least about 150°C;

installing means for circulating said primary absorption liquid between said primary absorption zone and said high temperature heat exchanger;

installing conduit for directing the gas stream exiting said high temperature absorber to an inlet of said existing interpass absorber; and

and about 99.7 wt.%, the concentration of the acid exiting the secondary absorption zone being between about 99.0 and about 99.7 wt.%.

133. A process as set forth in any of the preceding claims 1 through 132 that require passage of the gas stream through a secondary absorption zone, the concentration of the acid entering the secondary absorption zone being between about 98.0 and about 99.2 wt.%.

134. A process as set forth in claim 132 or 133 wherein the concentration of the primary acid entering the primary absorption zone is between about 99.2 and about 99.6 wt.%.

135. A process as set forth in claim 134 wherein the concentration of the acid entering the secondary absorption zone is between about 98.2 and about 99.1 wt.%

136. A process as set forth in claim 130 or 131 wherein the concentration of the primary acid entering the primary absorption zone is between about 98.5 and about 99.2 wt.%, the concentration of the acid entering the secondary absorption zone is between about 98.3 and about 99.2 wt.%.

137. A process as set forth in claim 136 wherein the concentration of the acid entering the primary absorption zone is between about 98.8 and about 99.2 wt.%.

138. A process as set forth in claim 137 wherein the concentration of the acid entering the secondary absorption zone is between about 98.4 and about 99.0 wt.%.

139. A process as set forth in any of the preceding claims 1 through 138 wherein the conversion gas contains at least 11% by volume equivalent SO_3.

140. A process as set forth in any of the preceding claims 1 through 139 wherein said sulfur source comprises elemental sulfur.

141. A process for the preparation of sulfuric acid comprising:

burning a source of sulfur in a gas comprising excess oxygen to produce a sulfur oxide-bearing gas stream comprising a combustion gas comprising sulfur dioxide and oxygen;

contacting the sulfur oxide-bearing gas stream comprising said combustion gas with a catalyst for conversion of sulfur dioxide to sulfur trioxide, thereby converting the sulfur oxide-bearing gas stream to a conversion gas containing SO_3;

contacting the conversion gas in a primary absorption (heat recovery) zone with a primary absorption liquid comprising sulfuric acid, thereby transferring sulfuric acid from the conversion gas to the primary absorption liquid;

introducing water vapor into the sulfur oxide-bearing gas upstream of the primary absorption zone with respect to the gas flow direction in a proportion sufficient to increase the equivalent water vapor content to at least about 0.40 moles per mole total equivalent sulfur oxide gas content in the gas entering the primary absorption zone;

circulating said primary absorption liquid between said primary absorption zone and an indirect heat exchanger in which heat generated by reaction of sulfur trioxide and water, condensation of sulfuric acid, and/or absorption of sulfur trioxide into the primary absorption liquid is transferred to a heat transfer fluid, thereby heating the heat transfer fluid to at least 150°C;

contacting the gas stream exiting the primary absorption zone with a secondary absorption liquid comprising sulfuric acid in a secondary absorption zone, residual SO_3 contained in the gas stream entering said secondary absorption zone being recovered as sulfuric acid in the secondary absorption liquid;

controlling the rate of delivery of secondary absorption acid to the secondary absorption zone to maintain the difference between the local bulk temperature of the gas phase and the

local bulk temperature of the secondary absorption liquid phase with which the gas is in contact not greater than about 35 °C at both the liquid inlet and liquid exit of the secondary absorption zone; and

controlling the concentration of the secondary absorption acid entering the secondary absorption zone to provide a net available water supply to the secondary zone sufficient to assure that the composition of the gas exiting the secondary absorption zone is equal to or above the azeotrope composition with respect to water content and equal to or below the azeotrope composition with respect to SO_3 content.

142. A process as set forth in claim 141 wherein the concentration of the absorption acid entering the absorption zone is controlled to assure that the composition of the gas exiting the secondary absorption zone is above the azeotrope composition with respect to water content and below the azeotrope composition with respect to SO_3 content.

143. A process as set forth in claim 141 or 142 wherein the equivalent sulfuric acid concentration of the gas exiting the secondary absorption zone is at least 0.2 wt.% lower than the azeotrope.

144. A process as set forth in any of claims 141 to 143 further comprising:

establishing and/or adjusting the rate of delivery of acid to the secondary absorption zone to maintain the difference between the local bulk temperature of the gas phase and the local bulk temperature of the secondary absorption liquid phase with which the gas is in contact not greater than about 35 °C at both the liquid inlet and liquid exit of the secondary absorption zone;

measuring and/or establishing the strength of the acid in contact with the gas exiting the primary absorption zone;

measuring and/or establishing the rate at which SO_3 is delivered to the primary absorption zone; and

from the rate at which secondary absorption acid is delivered to the secondary absorption zone, the strength of the acid in contact with the gas exiting the primary absorption zone, and the rate at which SO_3 is delivered to the primary absorption zone, establishing and/or adjusting the strength of the acid delivered to the inlet of the secondary absorption zone to provide a net available water supply to the secondary zone sufficient to assure that composition of the gas exiting the secondary absorption zone is above the azeotrope composition with respect to water content and below the azeotrope composition with respect to SO_3 content.

145. A process as set forth in claim 144 comprising measuring and/or establishing the temperature of the gas entering the secondary absorption zone, the temperature of the acid in contact with the gas entering the secondary absorption zone, the temperature of the gas exiting the secondary absorption zone, and the temperature of the acid in contact with the gas exiting the secondary absorption zone.

146. A process as set forth in claim 144 or 145 comprising a startup protocol wherein:

a select rate of delivery of SO_3 to the primary absorption zone and a select temperature of the gas exiting the primary absorption zone are established;

target ranges are selected for the temperature of the acid in contact with the gas entering the secondary absorption zone, the temperature of the gas exiting the secondary absorption zone, and the temperature of the acid in contact with the gas exiting the secondary absorption zone;

the delivery of secondary absorption acid to the secondary absorption zone is established at a rate effective to maintain the difference between the local bulk temperature of the gas phase and the local bulk temperature of the secondary absorption liquid phase with which the gas is in contact not greater than

about 35 °C at both the liquid inlet and liquid exit of the secondary absorption zone; and

the strength of the acid delivered to the inlet of the secondary absorption zone is established to provide a net available water supply to the secondary zone sufficient to assure that composition of the gas exiting the secondary absorption zone is above the azeotrope composition with respect to water content and below the azeotrope composition with respect to SO_3 content.

147. A process as set forth in any of claims 141 to 146 comprising:

measuring and/or establishing a select rate of delivery of SO_3 to the primary absorption zone and a select temperature of the gas exiting the primary absorption zone;

measuring the temperature of the acid in contact with the gas entering the secondary absorption zone, the temperature of the gas exiting the secondary absorption zone, and the temperature of the acid in contact with the gas exiting the secondary absorption zone;

adjusting the rate of delivery of acid to the secondary absorption zone to maintain the difference between the local bulk temperature of the gas phase and the local bulk temperature of the secondary absorption liquid phase with which the gas is in contact not greater than about 35 °C at both the liquid inlet and liquid exit of the secondary absorption zone;

measuring the strength of the acid in contact with the gas exiting the primary absorption zone;

measuring the rate at which SO_3 is delivered to the primary absorption zone; and

from the rate at which secondary absorption acid is delivered to the secondary absorption zone, the strength of the acid in contact with the gas exiting the primary absorption zone, and the rate at which SO_3 is delivered to the primary absorption zone, adjusting the strength of the acid delivered to

the inlet of the secondary absorption zone to provide a net available water supply to the secondary zone sufficient to assure that composition of the gas exiting the secondary absorption zone is above the azeotrope composition with respect to water content and below the azeotrope composition with respect to SO_3 content.

148. A process for the preparation of sulfuric acid comprising:

contacting an oxygen-containing gas with a desiccant to provide a desiccated oxygen-containing gas;

introducing sulfur and the desiccated oxygen-containing gas into a combustion zone, the oxygen content of the oxygen-containing gas introduced into said zone being in stoichiometric excess relative the sulfur introduced into said zone;

burning sulfur with oxygen of the desiccated gas to produce a sulfur oxide-bearing gas stream comprising a combustion gas comprising sulfur dioxide and oxygen;

contacting the sulfur oxide-bearing gas stream comprising said combustion gas with a catalyst for conversion of sulfur dioxide to sulfur trioxide, thereby transforming the sulfur oxide-bearing gas stream into a conversion gas containing SO_3;

contacting the conversion gas in a heat recovery absorption zone with an absorption liquid comprising sulfuric acid, thereby transferring sulfuric acid from the conversion gas to the absorption liquid;

introducing water vapor into the sulfur oxide-bearing gas upstream of the absorption zone with respect to the direction of sulfur oxide-bearing gas flow in a proportion sufficient to increase the equivalent water vapor content of the gas to at least about 0.55 moles per mole total equivalent sulfur oxide gas content prior to entry of the gas stream into the absorption zone; and

circulating said absorption liquid between said absorption zone and an indirect heat exchanger in which heat generated by

reaction of sulfur trioxide and water, condensation of sulfuric
30 acid, and/or absorption of sulfur trioxide into the absorption liquid is transferred to a heat transfer fluid, thereby heating the heat transfer fluid to at least 150°C.